The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Vol. XXIV, No. 13 CHICAGO June 18, 1921

EDITORIAL DEPARTMENT—

Nathan C. Rockwood, Editor
Chas. A. Breskin, L. R. Croy — Assistant Editors

ADVERTISING STAFF—

Charles H. Fuller, Eastern Manager, 101 West 41st Street, New York City

A. S. Barnett
Western Representative

SUBSCRIPTION—Two dollars a year to U. S. and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies.

TO SUBSCRIBERS—Date on wrappers indicates issue with which your subscription expires. In writing to have address changed, give old as well as new address.

POST-OFFICE ENTRY—Entered as second-class matter, July 2, 1907, at the Chicago, Ill., Post-office, under the Act of March 3, 1879.

ROCK PRODUCTS—

Geo. P. Miller, Manager
E. M. Gibson, Assistant Manager

Published every other Saturday by

TRADEPRESS PUBLISHING CORP.
542 South Dearborn Street, Chicago, Ill.

W. D. Callender, President.
N. C. Rockwood, Vice-President.
Geo. P. Miller, Treasurer.
C. O. Nelson, Secretary.

TABLE OF CONTENTS

FEATURE ARTICLES

DEPARTMENTS

For Index to Advertisements See Page 79

The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Vol. XXIV, No. 13 CHICAGO June 18, 1921

EDITORIAL DEPARTMENT—

Nathan C. Rockwood, Editor
Chas. A. Breskin, L. R. Croy — Assistant Editors

ADVERTISING STAFF—

Charles H. Fuller, Eastern Manager,
101 West 41st Street, New York City

A. S. Barnett
Western Representative

SUBSCRIPTION—Two dollars a year to U. S. and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies.

TO SUBSCRIBERS—Date on wrappers indicates issue with which your subscription expires. In writing to have address changed, give old as well as new address.

POST-OFFICE ENTRY—Entered as second-class matter, July 2, 1907, at the Chicago, Ill., Post-office, under the Act of March 3, 1879.

ROCK PRODUCTS—

Geo. P. Miller, Manager
E. M. Gibson, Assistant Manager

Published every other Saturday by

TRADEPRESS PUBLISHING CORP.
542 South Dearborn Street, Chicago, Ill.

W. D. Callender, President.
N. C. Rockwood, Vice-President.
Geo. P. Miller, Treasurer.
C. O. Nelson, Secretary.

TABLE OF CONTENTS

FEATURE ARTICLES

DEPARTMENTS

For Index to Advertisements See Page 79

This Bucket DIGS

Unequalled for hard digging and the speedy rehandling of heavy, tough refractory materials. A highly developed, powerful, quick-acting, lever-arm type clamshell bucket.

Strong, sturdy and simple construction—the closing mechanism is kept well out of the material handled—new moving parts (and those well protected) result in low upkeep expense on operating lines as well as on the bucket itself.

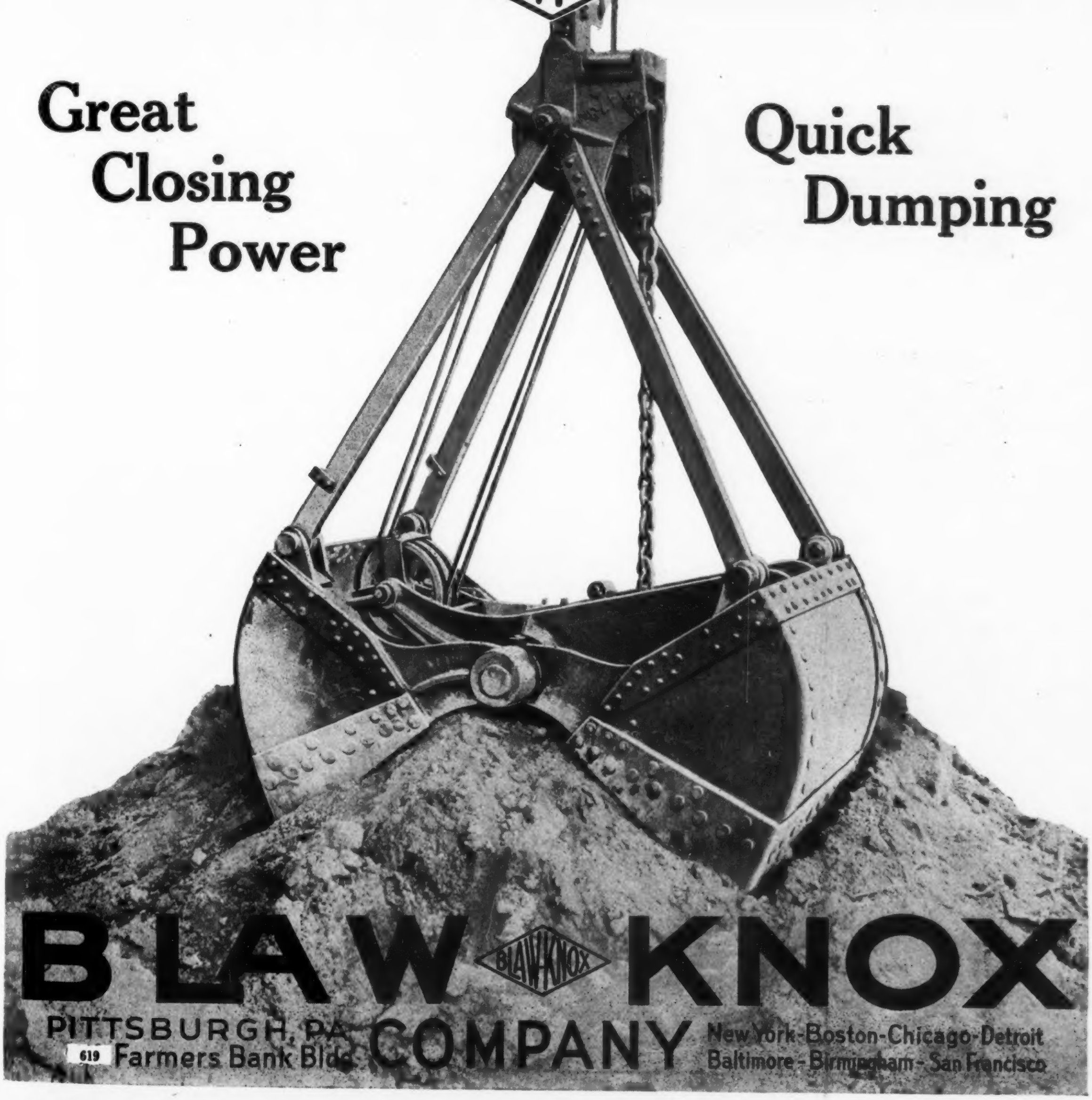
Suited to any type of crane—when in need of a bucket ask about

THE BLAW DREADNAUGHT

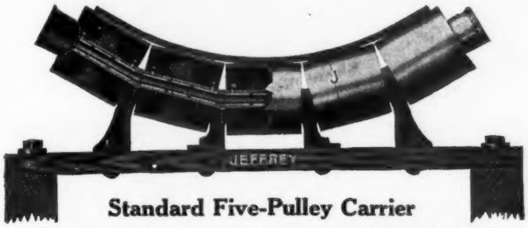
BLAW-KNOX

Great Closing Power

Quick Dumping



Showing how the Jeffrey Belt Conveyer and Tripper automatically and uniformly fill large bins or storage space



Standard Five-Pulley Carrier

Pulleys are set in line upon hollow renewable steel spindles connecting four rigid and well-proportioned supporting stands, giving an exceedingly rigid construction, with the spindles serving as a continuous tube through which grease is supplied to all the pulleys by means of only two large grease cups to each carrier

Handling Coke from Pit to Loading Tipple on a Jeffrey Belt Conveyer

Wide Range of Service on the Horizontal or up a Steep Incline

IN many places The *Jeffrey Belt Conveyer* is carried to great heights, and often have been applied in a way to take the place of two conveyors and an elevator by continuing an inclined conveyer over a storage bin.

The Jeffrey Five-Pulley Carrier embodies all the high qualities of our Standard Three-Pulley Carrier, and permits of a closer conformity to the natural troughing effect of the belt for the carrying of Ore, Rock, Earth, Sand, Gravel, Coal, Coke and other loose materials.

Catalog No. 175-A is a practical treatise containing 80 pages of data on the latest and best in belt conveyer practice. It will enable the busy engineer or manager to pick out the right conveyer to meet his requirements in a few seconds.

Send for a copy

The Jeffrey Manufacturing Co.

Columbus, Ohio

BRANCH OFFICES:

New York	Middlesboro, Ky.	Pittsburgh
Boston	Charleston, W. Va.	Dallas
Buffalo	Chicago	Montreal
Scranton	St. Louis	Detroit
Philadelphia	Milwaukee	Cleveland
	Birmingham	

Denver Office: 421 U. S. National Bank Bldg.
Los Angeles Office: Herman W. Hellman Bldg.

JEFFREY
MATERIAL HANDLING MACHINERY

PLYMOUTH

PLYMOUTH
Gasoline Locomotives

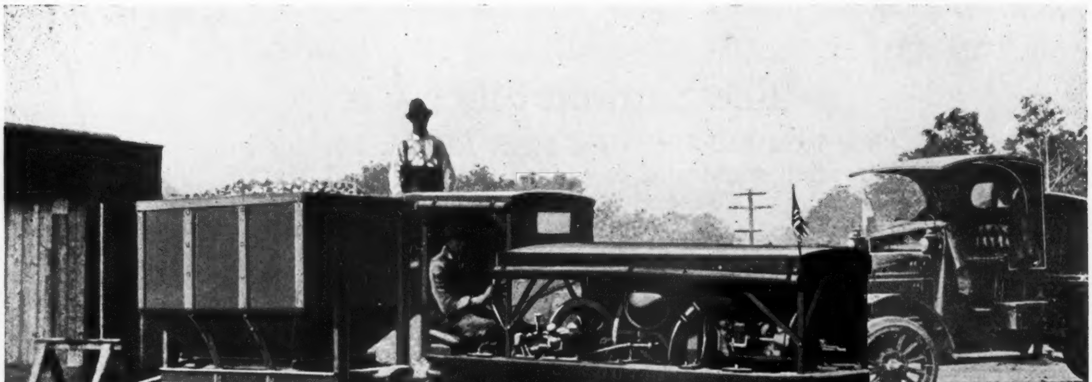
Commonwealth Quarry Co.

One good PLYMOUTH Gasoline Locomotive is usually followed by others. Plymouth haulage in the Commonwealth Quarries proved so profitable that a second PLYMOUTH was ordered.

Other Companies associated with the Commonwealth added PLYMOUTHS to their equipment until six were busy—making a total of *Eight* PLYMOUTH Gasoline Locomotives at work under the same general ownership.

The PLYMOUTH is akin to intelligence. It obeys the hand at the throttle, and delivers its super-power as evenly as the ribbon flows from the loom. Ask us for bulletins giving detailed information.

The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.



Illustrating PLYMOUTH Gasoline Locomotive in Plant of Commonwealth Quarry Co., Springfield, New Jersey

Rock Products

Vol. XXIV Chicago, June 18, 1921 No. 13

Preparing Rock Phosphate

For Acid Phosphate Manufacture

Mining, Washing and Drying Phosphate at the International Chemical Co. Plant in Preparation for Shipment to Fertilizer Manufacturers

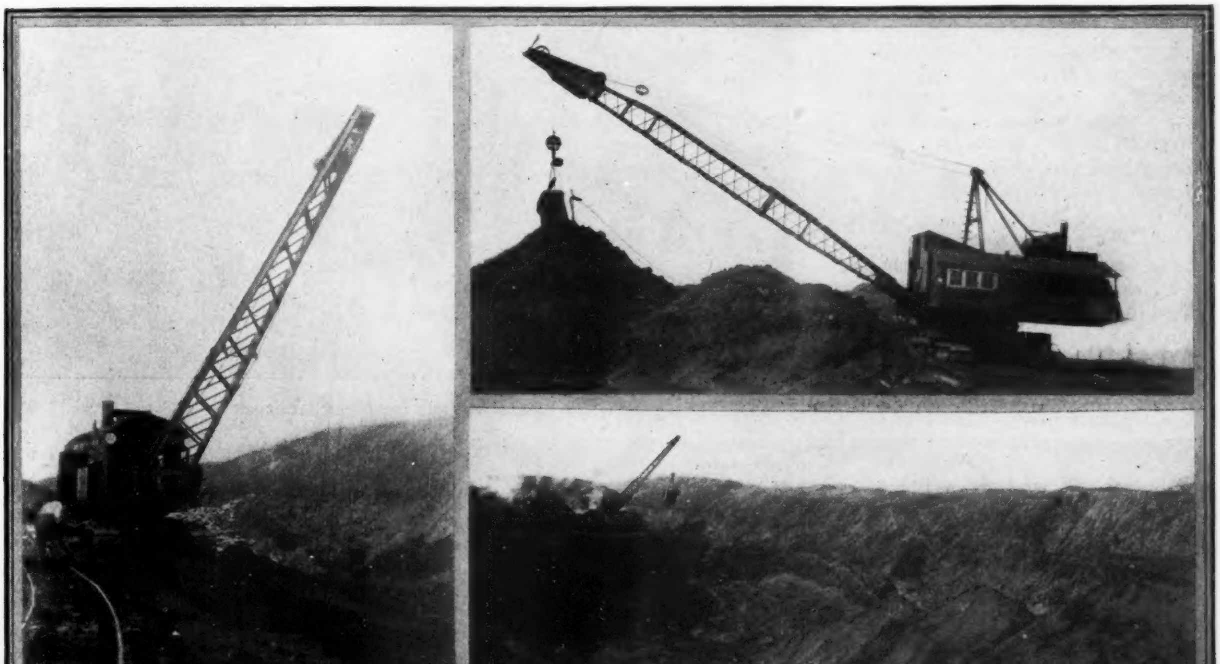
THE INTRODUCTION of the large-size drag-line excavator into the phosphate mining district of middle Tennessee was made by the International Chemical Co., which operates two large washing plants and a number of workings in this district. This company, which is operating entirely virgin property, has developed both its mining and washing operations a little differently than the other phosphate producers of the neighborhood.

The overburden, a peculiar, red, sandy clay, which runs from 4 to 15 ft. deep, is removed by a drag-line excavator which has a 70-ft. boom and a 2-cu. yd. bucket. The machine is run along as close to the face of the mine as is safe and the clay overburden is swung back into the portion of the pit that has already been worked out. Where the cut is heavy enough and of constant depth, a smaller drag-line excavator and narrow-gauge track and cars are used to supplement the larger drag-line. The phosphate runs as deep as 30 ft. at times.

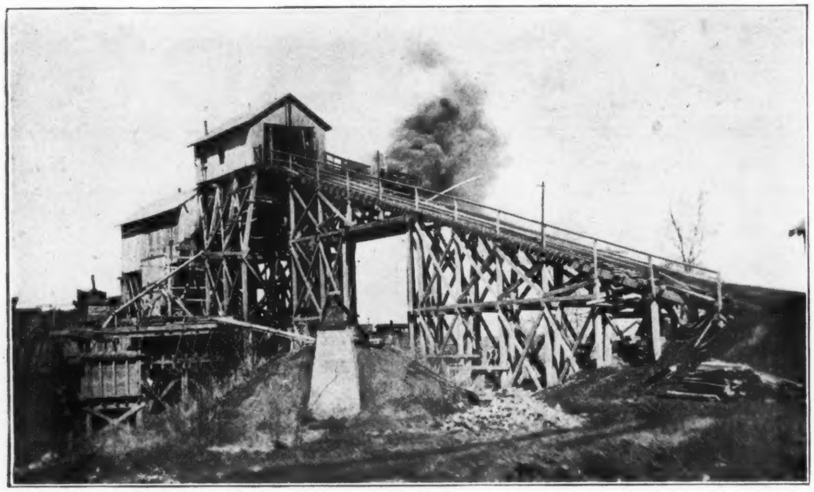
At one time a clam-shell excavator was tried out for mining, but was later given up because better results were obtained from the drag-line excavator. The phosphate rock is transported to the washing plant in small, wooden, 3-ton, end-dump cars. The workings are within a mile of the plant and four steam dinkeys are used for the transportation of the material—long trains of as many as 30 to 40 cars are drawn in at one time.

An incline similar to that of the ordinary gravel or crushing plant is used to elevate the cars to the tipple, where the material is washed out of the cars by a stream of water, when the car has been up-ended by a car dumper. This has been described under the department of "Hints for Superintendents" in ROCK PRODUCTS.

The phosphate falls into a flat sheet-steel pan, which is slightly sloped, and here the first washing is done. A hose is played on the material to wash it down



Various views of the phosphate mining operations of the International Chemical Co., near Mt. Pleasant, Tenn.

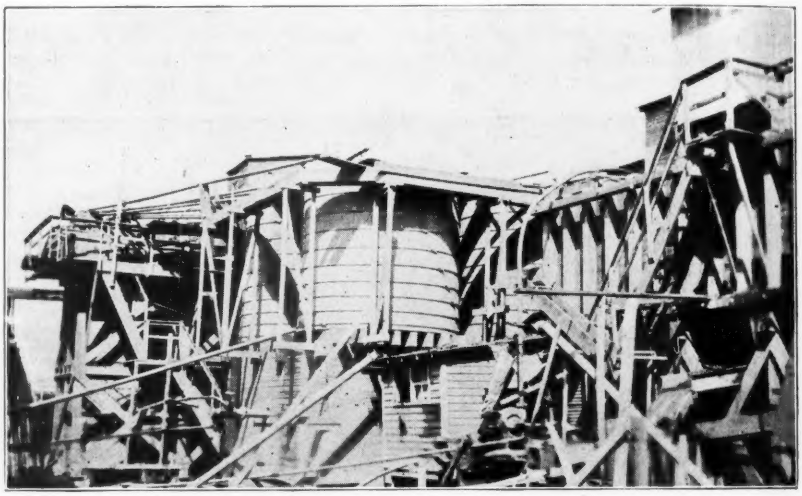


Railway incline to the washing plant

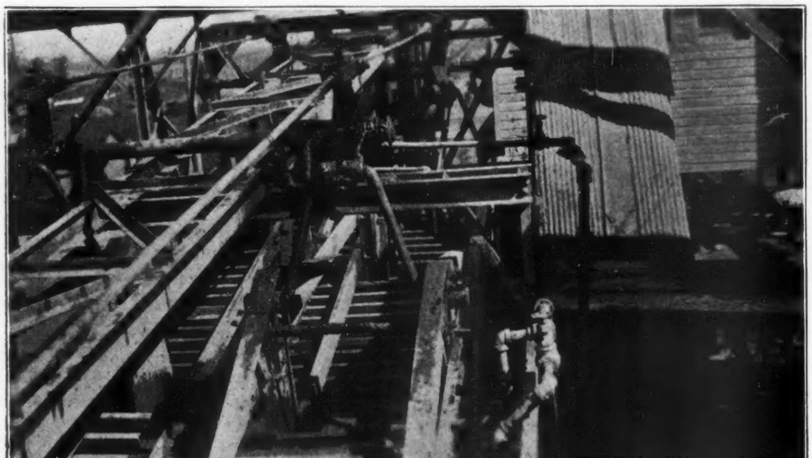
to the log washer. This consists of a rectangular box in which two long shafts with blades are rotated (like a pug mill). This action knocks the clay loose from the large material and thoroughly mixes the water and phosphate sand.

A cylindrical revolving screen at the foot of the log washers separates the material into rock and the finer material; here a second washing is also made. The rejections of this screen are sent to a mud pickers' belt, where any sticks, leaves or mud balls are removed by hand. The belt deposits the material into a large ground pile for drainage.

The sand and dirty water passing a ⅛-in. slot opening in the rotary screen all go to one large cylindrical tank washer, which has been designed by the engineers of the International Chemical Co. This consists of a wooden tank 18 ft. in diameter and about 20 ft. deep, with a spillway cut several inches below the level of the rim at one side. The water and material all flow into this and the solids immediately settle to the bottom and muddy water and the light material flow over the spillway.



Tank washers for phosphate rock



Hydraulic classifiers for phosphate sand

The sand is syphoned from the bottom of the settling tank into one of two 12-ft. tanks which are identical in design with the larger one. This sand water syphoning is accomplished by what is called a jet pump.

A 2-in. water-line delivers water at a pressure of about 100 lbs. per sq. in. to the bottom of the tank, where it is shot upward through a small circular orifice into a larger pipe. This orifice is below the sand level and there are several inches between it and this larger pipe so that sand is drawn in and all is forced into the second tank, and hence to a third set of tanks. In each tank the dirty water is run over a spillway and the material is rewashed by clean water introduced by the jet pump.

The muddy water from the spillways is sent to a set of interrupted flow riffle boxes, where more of the fine sand is deposited. The clean phosphate is delivered from the last set of washers to a set of Dorr hydraulic classifiers, where the sand is separated from the water and is deposited in the same drainage yard that the rock was delivered to.

In the near future a Dorr thickener will be installed to take the place of the intermittent flow riffle boxes, where it is claimed that 40 to 60 tons of less than 100-mesh phosphate is lost per day.

A traveling electric crane is used in the drainage yard to distribute the wet phosphate and to deliver the partly dried product to the coal-burning driers. Because of the partial drying which the material gets before going to the driers, it is fed into the cool end of the drier. This is quite contrary to practice of other phosphate producers, who feed the hot end of the drier.

Bucket elevators deliver the dried product to overhead electric-trolley operated cars and hence to the storage shed. An

underground traveling hopper and conveyor belt is used to reclaim the product and a special car loader puts the phosphate into box cars. The storage and box car loaders have been described in previous issues of ROCK PRODUCTS.

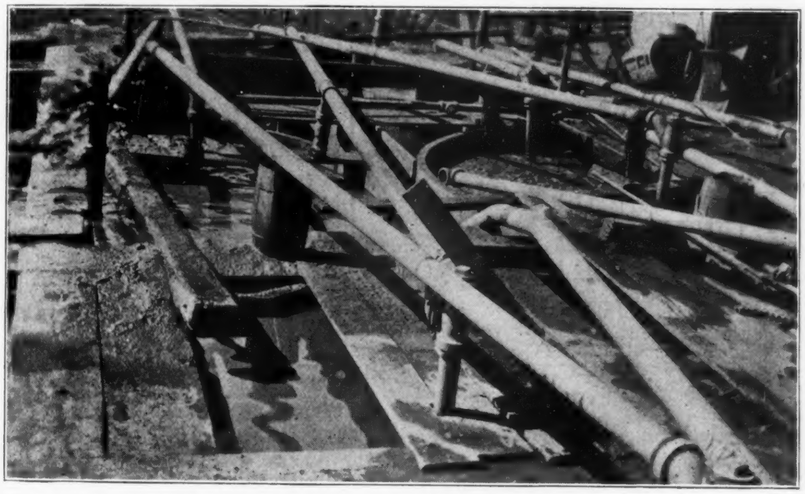
The entire plant is electrically operated. The power is manufactured by the company and individual motors are installed to drive the different units.

James A. Barr is consulting engineer in charge of construction and operation. The company is now building two new plants.

Top view of the tank washers

Large Production of Fuller's Earth in 1920

THE PRODUCTION of Fuller's earth in 1920, according to a statement made public by the United States Geological Survey, Department of the Interior, was 128,487 short tons, valued at $2,506,189, or $19.51 per ton. These amounts represent the largest output, the largest value, and the largest average price ever recorded. The output was 21 per cent greater than in 1919; it was more than three times as great as in 1913, and nearly nineteen times as great as in 1895, the first year of production. The value in 1920 was 25 per cent greater than that in 1919, nearly seven times as great as that in 1913, and 60 times as great as that in 1895. The average price per ton in 1920 increased only four per cent over that in 1919.

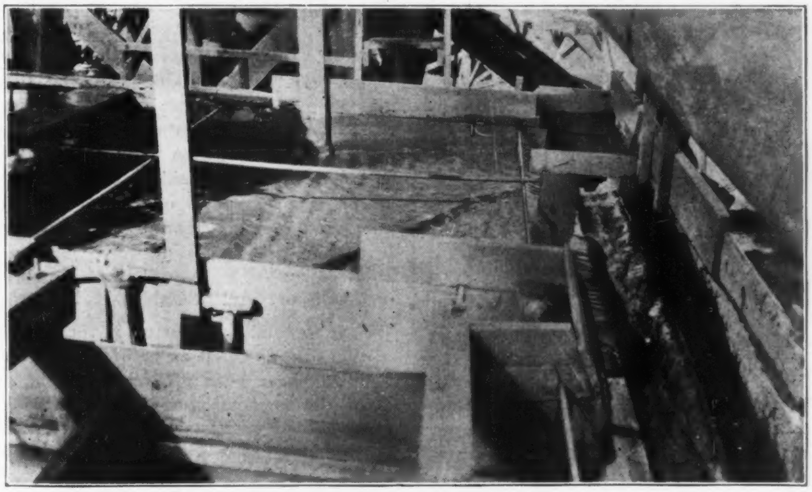


Overflow from washers to riffles

Fuller's earth was produced in eight states in 1920; named in the order of their rank in output, they were: Florida, Georgia, Texas, Alabama, Nevada, Arkansas, California, and Massachusetts. Promising deposits of Fuller's earth have been discovered also in Pennsylvania and Virginia. The Southern States reported 99 per cent of the output, Florida alone reporting about 85 per cent of the total.

The imports of Fuller's earth, which for many years constituted the entire source of supply, also increased in quantity and value in 1920. During the war these imports naturally decreased in quantity, and with the cessation of hostilities they just as naturally increased. The imports of 1918 were about 50 per cent of the maximum (24,977 short tons in 1914); in 1920 they were 77 per cent of the maximum. During the war some refiners of edible oils and fats—by whom the imported Fuller's earth is probably used exclusively—were unable to obtain a sufficient supply of foreign earth and were compelled to adopt domestic earth to their needs, and it may be that imports of this material will never again be so essential to the American industry.

The imports of Fuller's earth in 1920 were 19,235 short tons, valued at $221,893, or $11.54 a ton. These amounts represent an increase of 39 per cent in quantity and of 17 per cent in value.



Riffles for recovering fine phosphate sand

Improvements in Dry Grinding

The Long Tube Mill—The Short Ball or Pebble Mill—Advantages of Circulating Load—Typical Layouts of Pebble and Ball Mills

By Harlowe Hardinge
Hardinge Company, New York City

WITH REFERENCE to grinding by the use of ball and pebble mills as described in the article entitled, "Improvement in Tube Mills," by Richard H. Vail, in the April 23 issue of Rock Products, further discussion on this important subject seems desirable.

The Long Tube Mill

The only excuse for the use of the long tube mill for dry grinding in open circuit,

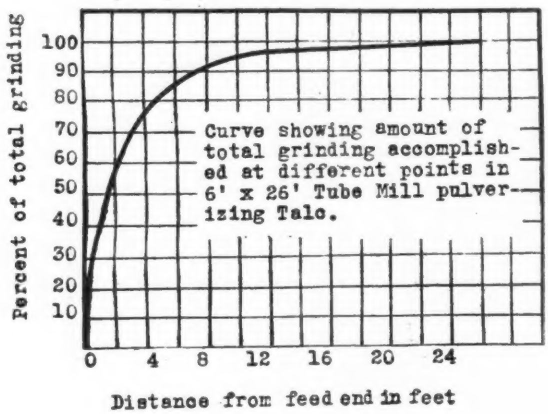


FIGURE 1

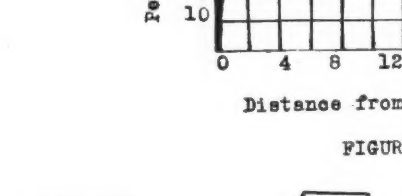


FIGURE 2

where a fine product is desired, is its extreme simplicity of operation. The objection to its use is the fact that it consumes too much power commensurate to the actual work performed. Even with this high power consumption, it is generally preferred to the high speed pulverizer which is very expensive, owing to high repair and labor cost.

As concrete evidence of the great waste of energy in the long tube mill, operating in open circuit, a test was run several years ago on talc in a 6x26-ft. tube mill. Samples of the material in the mill were taken at intervals throughout its length. a screen analysis of each sample was made and the percentage of the total grinding calculated. A curve plotted between, "Percentage of Total Grinding," and "Distance from Feed End in Feet," is shown in Fig. 1. The result is startling!

By reference to this curve, it is evident that over 80% of the total grinding is accomplished within the first 5 ft. of length of the tube mill, or, in other words, the balance, or 20% of the total grinding, consumed more than 80% of the total power.

The Short Ball or Pebble Mill

If the mill were cut off at the 5-ft. section and operated as before, the product would have been ground to within 20% of the fineness required. This product would be unsatisfactory, but if an adequate sizing device were employed and the oversize or partially ground material returned to the mill for regrinding, the product from this combination would be satisfactory. It has been found that short pebble or ball mills are far more economical to operate in the majority of cases in conjunction with air separators or screens, than a long tube mill in open circuit.

In the past the tube mill, when operated in closed circuit, was not very satisfactory, as an attempt to over feed, so as to increase the "circulating load" and improve the grinding efficiency, resulted in

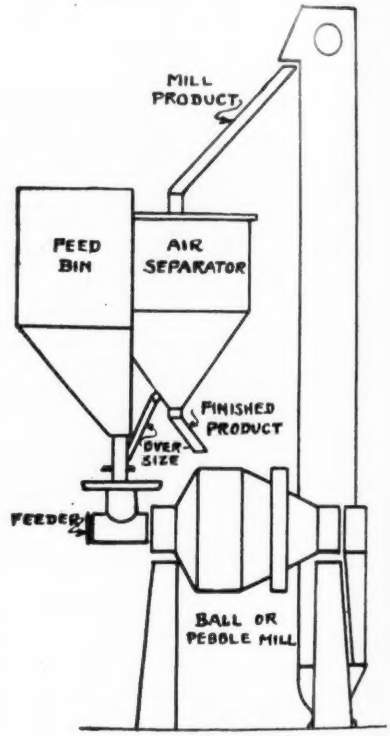


FIGURE 3

choking the mill, but radical changes in the design have made it possible to increase the rate of travel through the mill, and at the same time get the desired grinding effect, without choking and sacrifice of fineness.

The cost of operation of the short mill in closed circuit, including power consumption, labor, repairs, etc., is far below that of the excess cost of power required by the long tube mill to do the same work.

Some operators contend that the short mill does not produce a sufficient amount of "impalpable" powder. This is true unless the short mill is operated in closed circuit with some type of sizing device.

Then even more extremely fine material can be produced, as the regulation is positive and the cushioning effect is reduced. It is the very great cushioning effect of the finished material in the tube mill which is the main cause for its low efficiency. The grinding media do not get a chance to do effective work. It is just like trying to pulverize sea sand on the beach by pounding it with a hammer, without putting any hard substance underneath to prevent the sand from spreading out and dissipating the energy without obtaining any appreciable result.

Typical Layouts of Pebble and Ball Mills

Figs. 2, 3 and 4 show some of the more recent developments of grinding in closed circuit with sizing devices. In such cases, a very closely regulated and uniform product can be obtained. Contrary to the belief in certain industries, an extremely fine product can be maintained on either soft material, such as barytes, or hard material, such as silica, anthracite coal or cement clinker.

Fig. 2 shows a ball or pebble mill operated in closed circuit with a vibrating screen. This type of electrically vibrated ("Hummer") screen has been of great assistance in making a success of this method of grinding, as the troubles usually encountered with screens, such as blinding, tearing, and low efficiency, have been greatly minimized and a very high percentage of operating time can be maintained over a period of years. By operating this unit so that a "high circulating load" is maintained, the capacity is increased beyond that which would have been the maximum for the long tube mill. In other words, by the use of adequate separating devices, the power is cut and the capacity greatly increased for given sizes of units.

Another very satisfactory arrangement is shown in Fig. 3, where the mill is operated in closed circuit with an air separator of the Emerick type. The principal advantage of this system is the low power consumption and simplicity of operation where a fairly fine product is desired.

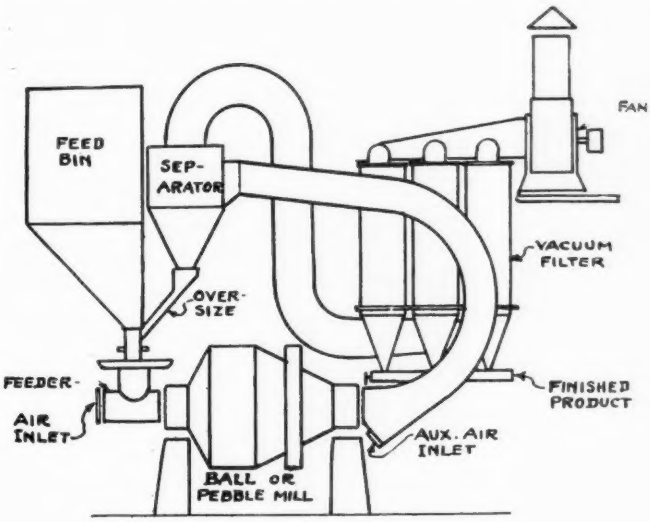


FIGURE 4

For extremely fine grinding, or where it is desired to have an absolutely dust-proof and self-contained installation, the system outlined in Fig. 4 has been found very satisfactory. In addition to its being dust-proof and self-contained, by "air sweeping" the mill itself, the fines held in suspension by agitation are removed as soon as produced, also material of relatively high moisture content can be handled satisfactorily. While an installation of this sort will take more power to effect the same separation, the net result is about the same, as in "air-sweeping" the mill, the capacity is actually increased as additional finished material is obtained.

In any event, the use of a short tube mill or conical mill more particularly, while it is possible to maintain a rapid circulation of material, the total power required is well below that of the long tube mill operating in open circuit and other types of pulverizers, using air separation or screens. As for repairs, little need be said, for it is a generally accepted fact that of all grinding devices used today, where there is any abrasive effect whatever, the short ball or pebble mill requires by far the lowest expenditure. This also means that the percentage of operating time—a most important factor—is much higher.

There are other methods of combining mills and separators which have their advantages under different conditions, either as to first cost or method of operation. There are so many combinations that it would be impossible to set them all down here. It might be well to mention, however, the method where a cyclone collector is used instead of suction filters. The air issuing from the cyclone is either allowed to escape to the atmosphere or is sent back to the feed end of the mill. In the latter case it prevents the extremely fine material, not caught the first time, from passing to the atmosphere, but takes it back through the mill and keeps it in the circuit until it is ultimately caught by the cyclone.

New Canadian Cement Plant

THE Canada Cement Co., Ltd., has recently completed a new cement plant at Tuxedo, Man., and has another under construction at Medicine Hat, Alberta. The addition of these two plants make 14 plants owned by the company, three in Quebec, six in Ontario, one in Manitoba, and four in Alberta. The total productive capacity of all the plants combined is 12,000,000 barrels of cement annually. The company employs 2,000 men.

The plant located at Tuxedo, Man., is seven miles south of Winnipeg. The buildings are of structural steel with corrugated iron roofs and sides. The plant has a capacity of 100,000 barrels of cement per month. Two storage buildings are provided for finished cement. These are of reinforced concrete construction, and so constructed as to insure protection against moisture.

The plant operates under the wet process and has four kilns 10 ft.x150 ft. for burning the slurry into clinker. The waste heat from the kilns is used to dry the raw material.

The plant has 95 electric motors and is electrically-driven throughout. The motors vary in size from 1-h.p. to 300-h.p. The 300-h.p. motors, of which there are five, drive a No. 2 F. L. Smidth tube mill which grinds the raw material until it passes through a 200-mesh screen. Five 100-h. p. motors drive a No. 85 "Kominutor" for reducing the stone to a suitable size for tube mill feed. Five 100-h. p. motors drive another No. 85 "Kominutor" reducing the clinker from the kilns for the tube mill feed. There are six tube mills on the clinker grinding side operated by 175-h. p. motors. A great quantity of conveyor belting is used, there being about 2,500 lineal feet of 24-in. belting.

The company has a limestone quarry at Steep Rock, about 170 miles from the plant. Clay is available in unlimited quantities on the site of the plant. A clubhouse has been erected and five stucco houses. More houses will be erected.

As at other plants of the company, a well equipped laboratory has been installed to ensure uniform high-grade cement. J. S. Downs is superintendent of the Tuxedo plant.

Hints for Superintendents

Gravity Track Layout

AN UNUSUAL METHOD of transferring crushed stone from the screens to the storage bins is found at

Track toward screening plant

Track toward storage bins

the plant of Dudley & Orr, El Paso, Tex. This is largely the result of local conditions as the quarry and plant are located in a mountain (Mt. Franklin) some 4,200 ft. above sea level. The quarry face is 300 ft. in height and the distance from the crushing and screening plant to the stone storage bins is 750 ft., down a 15-per cent grade.

Storage bins

The views accompanying this article illustrate the track layout from the screening plant to the stone storage bins. The empty car is loaded under the small bins below the screens while the loaded car is being emptied at the stone storage bins. As the loaded car is released it goes downgrade, drawing the empty car back to the bins underneath the screens. The cable length being constant the cars always pass at the same point. One car has its cable on the top while the other car has its cable on the bottom. The cable unwinds on top as the loaded car goes down, but winds up on the bottom to draw the empty car up. On the return trip the case is just reversed.

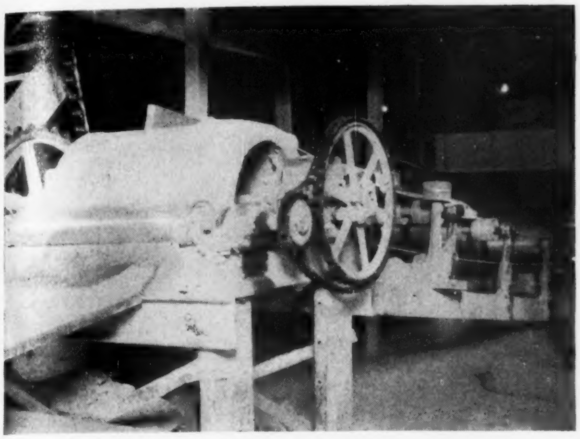
The track layout is such that three rails take the place of four. A sidetrack and a switch permit the cars to pass. The middle rail is used by both the descending and the ascending cars excepting at the switching point.

Concrete Pulleys for Belt Conveyor

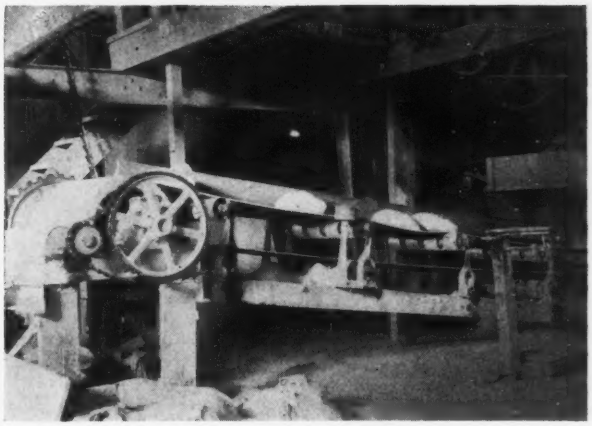
THE "concrete for permanence" idea has begun to show itself in the form of pulleys for belt conveyors. The views presented herewith show a concrete pulley for a belt conveyor receiving sacked cement from a valve bag packer at the plant of the Western States Portland Cement Co., Independence, Kan.

During the war when it was extremely hard to get delivery on any equipment

Switching points



Concrete pulleys for belt conveyors



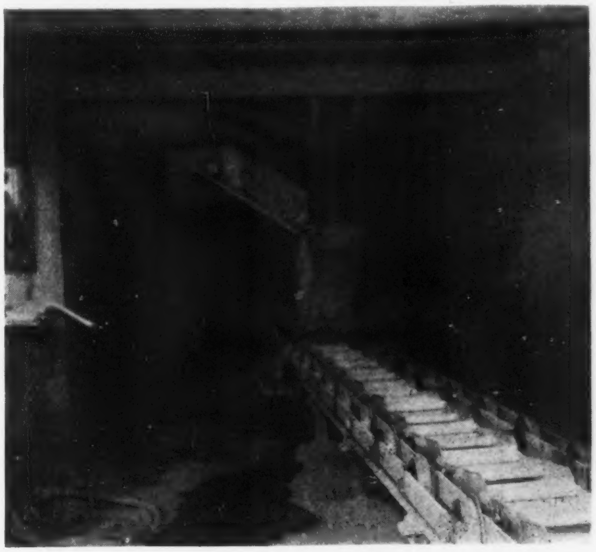
Receiving sacked cement

whatsoever, the superintendent of the plant found himself in urgent need of a driving and tail pulley for a belt conveyor. He decided that instead of waiting for delivery on a steel pulley he would build one of concrete. Accordingly, he built the wooden form for a pulley 24-in.x36-in. and cast his concrete in the ordinary manner. The shaft for this pulley was fastened to the concrete by arms extending from the shaft to the inside periphery of the cylinder. In this manner the pulley was made rigid and true.

The steel roller shown in the front of the pulley serves a double function—to keep the concrete smooth by acting as a dressing wheel and to break the fall of the sacked cement as it comes over the belt conveyor. The steel roller is driven from the concrete head pulley by a sprocket wheel and chain.

In this plant the valve bag packers are located on a raised platform. The operator also sits on a raised platform and the belt conveyor referred to above runs underneath this platform. As the cement is sacked it falls on this conveyor and at the end of its course it is caught by a man, who places it on a truck for transfer to the car for shipment or to the cement storage.

Chain drag conveyor receiving clinker from kiln



Chute and pivoted bucket carrier to clinker storage

Temporary Cement Clinker Handling Arrangement

THE TWO VIEWS presented herewith show a temporary method of handling hot cement clinker during the absence of a rotary cooler. This was developed at the new plant of the Oklahoma Portland Cement Co., Ada, Okla.

The cooler consists merely of a motor-driven drag conveyor. As the hot clinker is fed to the drag conveyor from the kiln, it first receives a light sprinkling with water. The chain then drags the clinker to a pit, from which it is spouted to a 24x18 in. Perkins pivoted bucket carrier, which delivers to the clinker storage.

The clinker storage consists of 10 reinforced concrete silos, 26 ft. in diameter and 86 ft. high, having an approximate total capacity of 110,000 barrels. The Perkins pivoted bucket carrier that conveys the clinker to storage is used to withdraw them from the silos on its return run, elevating the clinker to the mouth of the compeb mill clinker bins.

This device is said to give as good satisfaction as a rotary cooler, with less expenditure in power. M. O. Mathews is manager of the plant at Ada and R. C. Rodarmel, superintendent.

Superintendents from time to time find out new ways of doing old things or adapting old ways to new things. Nearly everyone has some pet kink that it would be profitable to him to exchange for the pet kink of another fellow. This department is the place to make the exchange. —*Editor.*

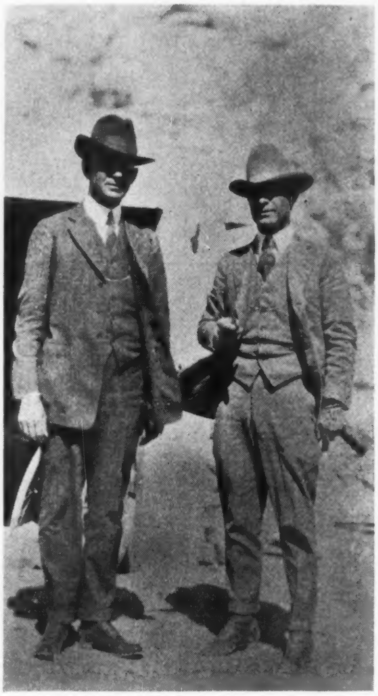
A Texas Limestone Quarry

Dudley & Orr, El Paso, Texas, Operate Unusual Side-Hill Crushed Stone Plant

PROBABLY the most unusual commercial crushed stone operation in Texas is that of Dudley & Orr, El Paso. As the views herewith indicate the quarry is ideally located with a whole mountain of rock to draw on. It is situated in Mt. Franklin, some 4,200 ft. above sea level. The rock is a blue, carboniferous limestone, short-grained, and breaks into angular fragments. It is very hard and durable and is an excellent material for all the uses of crushed stone. Its specific gravity is 2.71 and French coefficient of wear from 17 to 24; the hardness is 17.1 and the compressive strength 27,350 lbs. per square inch.

Quarry Operation

The company owns 10 acres of stone land in this mountain, which offers a practically inexhaustible supply of stone. The quarry is of circular shape, having a face 300 ft. in height. Tripod drills are used for blast holing. The average depth of the holes is 28 ft. The drilling is done on a bench and at such a slope that the rock, on blasting, falls easily to the quarry floor. The drill holes are first sprung with 40-per cent gelatine dynamite and then shot with black powder. This is necessary because the City of El Paso lies immediately below the quarry.



J. M. Dudely and Wm. B. Orr

The broken rock is loaded by a Model 60 Marion railway-type steam shovel with a 2½-cu. yd. dipper into 4-cu. yd., 36-in. gauge, side-dump cars. It is then hauled by mule to the crusher, a distance of about 150 ft., around a circular track following the face of the quarry. The distance of the complete circuit is some 550 ft. The company contemplates to replace the mule system of haulage by either a steam dinkey or gasoline locomotive.

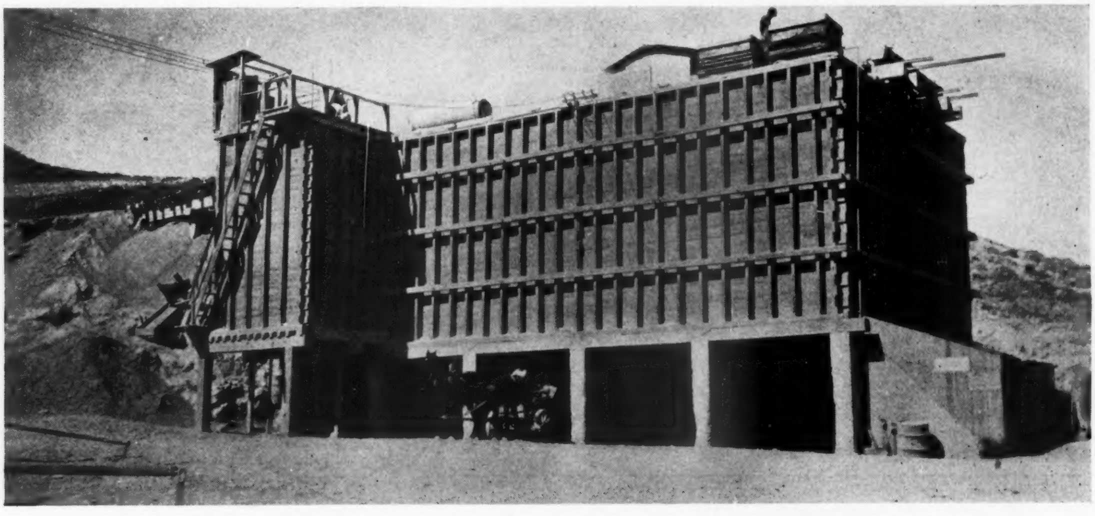
Initial Crusher

The quarry cars dump into a 36x48-in. Traylor jaw crusher, located right on the quarry floor. This crusher has a capacity of 200 tons per hour and reduces the stone to a 4½-in. size.

Getting this crusher from the railroad terminal in El Paso to the quarry site was quite a problem, since the quarry is approximately 500 ft. above the city. The crusher was placed on a flat truck and hauled up by a series of two trucks and two tractors, as illustrated in this article.

Crushing Plant

The rock from the jaw crusher is discharged onto a 30-in. belt conveyor, 60-ft. centers, at an inclination of 18 degrees, which discharges into a hopper feeding either or both of two No. 6 gyratory crushers, which reduce the stone to 3-in. maximum size. From the crushers the stone feeds by gravity into two 40-in. diameter by 20-ft. long screens, fitted with ¼-in., ½-in. and 2½-in. perforations. The material going through the various meshes is distributed to the bins, while the oversize is chuted to a bucket elevator of 45-ft. centers, which discharges into a No. 4 gyratory crusher. Each screen has one elevator and one No. 4 crusher. The No. 4 gyratories reduce the stone to 1½-in. and it is then chuted into another screen, 38 in. in diameter, 20 ft. long, with perforations similar to the other two screens. The stone is distributed from the screens into the various compartments of the bin, of which there are five, having a com-



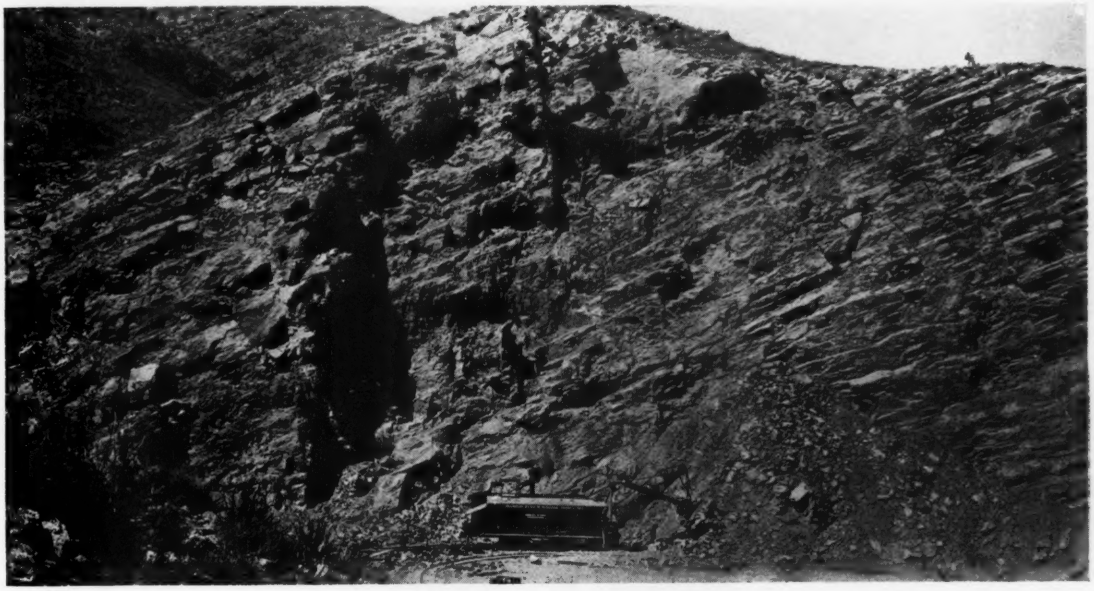
Storage bins showing concrete driveways. Note transfer cars unloading on top

bined capacity of 100 tons. This plant reduces entire output to 1½-inch when necessary.

Storage Facilities

The bins comprise only a temporary storage for stone and are for the purpose of classification of sizes. For transferring the stone to the permanent storage, two steel cars of 1¾ cu. yds. capacity each are run underneath the bins and loaded with stone. The cars are of the inverted V-dump type and are loaded from the bins through a gate feeder. They are then gravitated to the storage plant, down a 15-per cent grade and a distance of 750 ft., at the same time pulling two empty cars back to the bins from the permanent storage. This system is explained in the "Hints for Superintendents" department in Rock Products.

At the permanent storage the cars are dumped into any of five compartments having a combined capacity of 2,500 tons. Underneath these bins are five concrete driveways, each driveway having three gates for loading the stone. In this manner, two tracks or wagons may be loaded in one driveway at the same time. The trucks and wagons then haul the stone to a tipple, a distance of one mile, from which the railway cars are loaded. The tipple has a double track and is capable of holding nine cars. The entire output of the plant is 1,500 tons per eight-hour day.



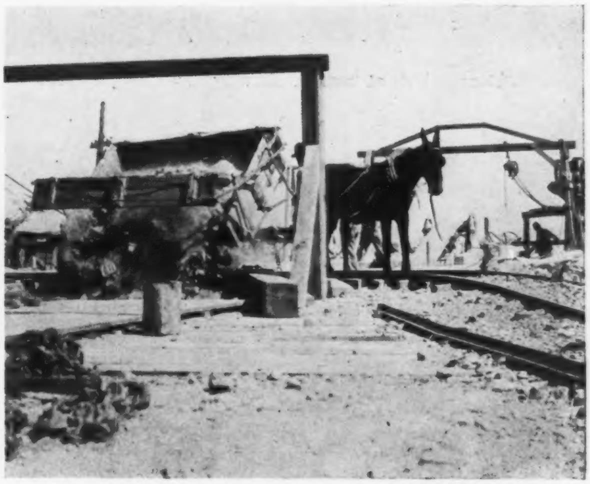
View of quarry face showing dip of rock. Note tripod drill in the upper right-hand corner

Distribution is also made to all parts of the city by truck and wagon, direct from the storage bins.

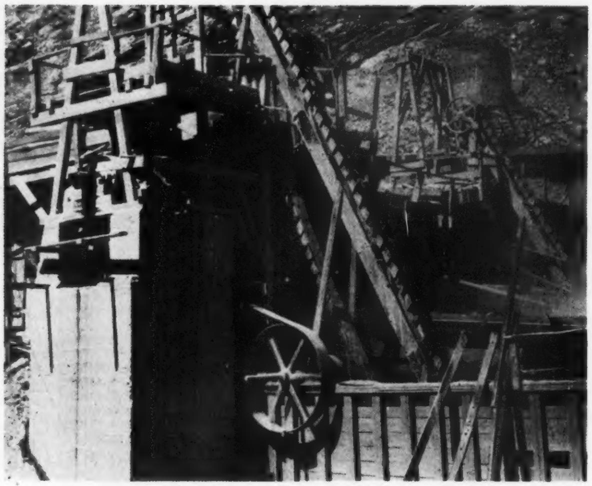
The company, which was organized in 1913, consists of a partnership between J. M. Dudley and Wm. E. Orr. L. K. Williams is general accountant and purchasing agent and R. E. Gates is general superintendent. Besides the crushed stone plant the company also engages in construction work. Prior to 1912 both partners were engaged in railroad construction work in Mexico.

They also operate another quarry in the vicinity of the one described, from which they furnish high calcium stone for fluxing purposes to the smelters about El Paso.

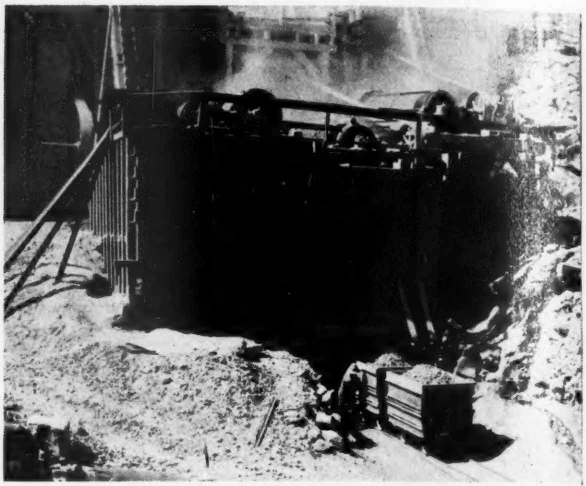
Steam shovel loading into quarry cars



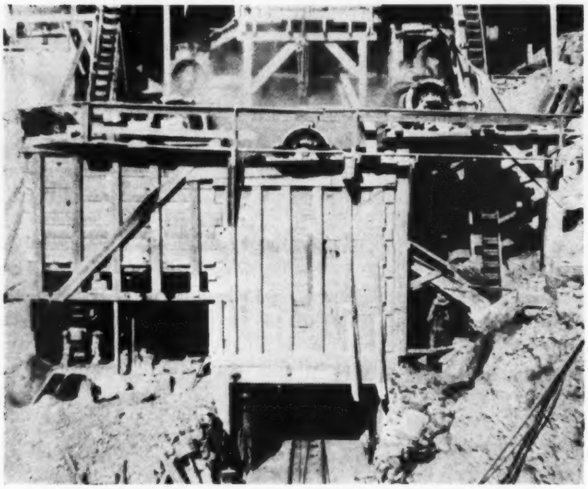
Dumping the stone into the jaw crusher



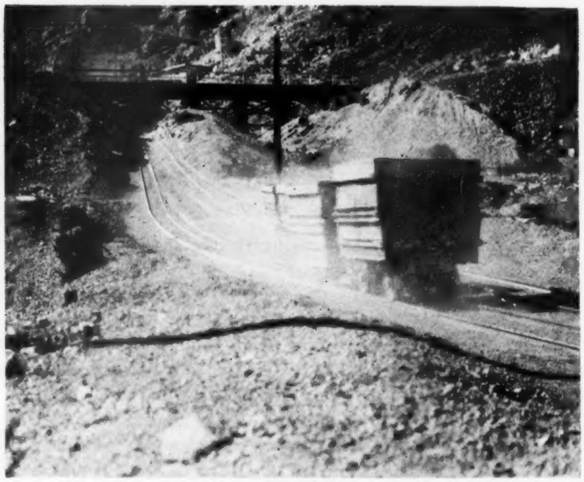
Bucket elevators distributing stone back to crushers



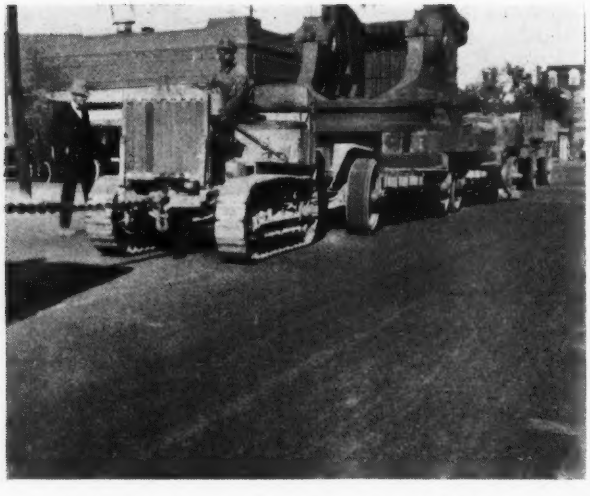
Loading transfer cars underneath storage bins at crusher



Storage bins at crusher showing the sizing screens



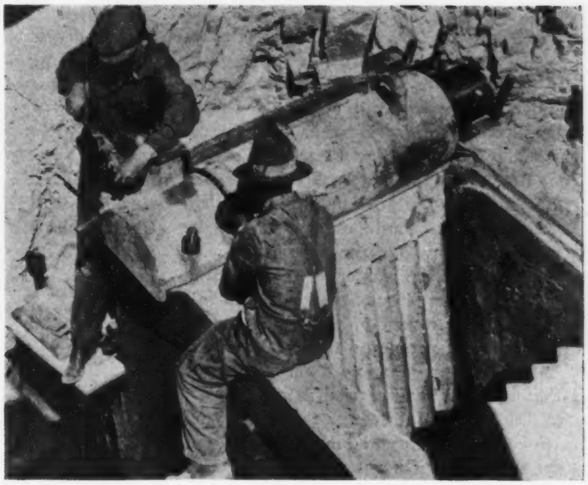
Transfer cars passing at switching point



Hauling jaw crusher through streets of El Paso

Hauling crusher up the mountain to the plant

Jaw crusher mounted on flat truck



Crusher on foundation in quarry floor

New Process Gypsum Mill at Fort Dodge, Iowa

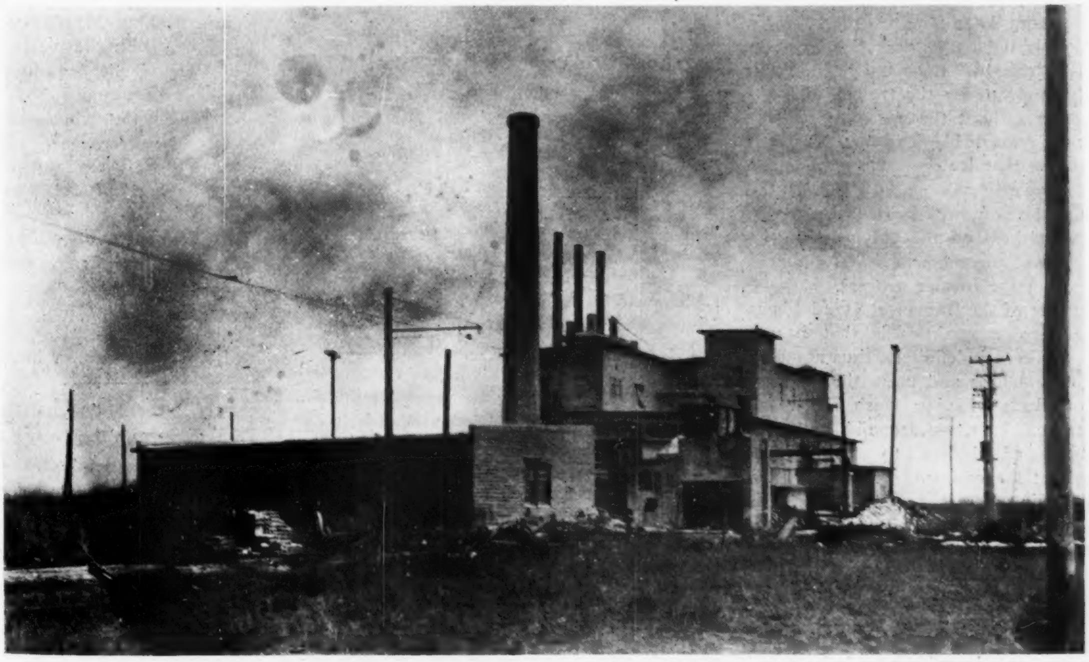
Plymouth Gypsum Company Opens the "Iowana," a Four-Kettle Mill

THE Iowana mill, a new fireproof plaster mill in Fort Dodge was formally opened June 15 by the Plymouth Gypsum Co. The new mill is located one mile south of Fort Dodge, Iowa, on the Minneapolis & St. Louis R. R.

The old Corn Belt Packing Co. building at that place was remodeled and a four-kettle mill with a capacity of from 700 to 800 tons in 24 hours' operation was installed. The particular feature of the new mill is that it will manufacture the new process plaster. Gypsum for the mill will be mined from the Plymouth mines west of the Des Moines River.

The Iowana has been under construction for the past 17 months, and regarding its product, Mr. J. E. Armstrong, president of the company, says:

"A remarkable new process plaster is being manufactured. This material has



The "Iowana" Mill, Plymouth Gypsum Co., Fort Dodge, Iowa, taken in process of remodeling

been tested by the government under the supervision of Mr. Warren E. Emley of the Bureau of Standards, the originator of this process. All the machinery and appliances in this mill comply with the specifications of the Bureau, which is remarkable in that the Plymouth people did not know about this discovery when the plans for the Iowana mill were laid out and not a single change had to be made to follow out the specifications.

"Samples of the plaster have been tested by the said Bureau of Standards, and following is the report of the results wired the Plymouth people on the first test:

"'Sample too plastic. Your process is right but you have carried it too far.'

"The letter following this wire explained that it was ground too fine and that this was not necessary. On the second sample sent the Bureau, the results and their comments were as follows:

"'We are glad to advise you that it is just about right and have no further suggestions to make on the subject as we believe you have now succeeded in producing the desired working material.'

Numerous Tests

"The Plymouth people report that they have made numerous tests as to the strength, spreading and plastic qualities, and are more than gratified with the results. The tensile strength of the material when mixed two parts of sand to one of plaster, which are the standard specifications used by all manufacturers, shows it to be from 20 to 25 per cent stronger than the plaster made under the old process. It mixes more readily with sand and spreads freely under the trowel, and can be darbied without the use of water. It has other remarkable features, one especially being that it does not dust like the old process material. This is due to the fact that the new process material retains more moisture than the old process. In view of this, the material is 10 per cent whiter than the former process.

"The test of the Bureau of Standards as to the keeping qualities is that it will practically keep indefinitely, thus assuring the plaster sellers and users the satisfaction of always having fresh stock for their trade. This, we are told, will save thousands of dollars to the dealers throughout the country, especially in the small towns where the sale of plaster is slow, necessitating them to keep plaster in stock during the hot months when it deteriorates and practically becomes useless after a certain time.

Experiments Made

"Experiments have been made by noted chemists for a number of years to overcome the deterioration of gypsum plaster so as to obtain 100-per cent efficiency. This has been accomplished in a limited way by the addition of chemicals and other materials. But this new process material will make plaster a staple article for the dealer to carry in stock 12 months a year instead of only ordering as business demands on short notice and in small lots.

"One of the many good features of this material is that it will cost no more to manufacture.

"They will also have a finish manufactured under this new process which will require no lime. It will be ready by adding water only, will be hard as stone, will spread farther and work better than the old-style lime and stucco finish.

"The products of the Iowana mill will be sold by the Plymouth Gypsum Co."

With the addition of the new mill, the Plymouth Gypsum Co. becomes one of the largest gypsum producers in the Northwest.

A description of the Iowana mill was published on page 32 of Rock Products, November 20, 1920.

A Spectacular Blast

Blast in Canadian Quarry Breaks 26,000 Cu. Yds. of Stone

THE Ontario Rock Co., at Preveneau, three miles east of Havelock, Ont., had a spectacular blast at its quarry recently when 26,000 cubic yards of rock were broken in one blast.

In December, 1920, two tunnels were started. In the west drift a tunnel was driven 60 ft. north, 60 ft. west and 10 ft. east. Pockets were made in the south side of the west heading. These headings were loaded with 180 cases of 60-per cent nitro-glycerine dynamite, distributed in seven charges. In each charge were two No. 8 electric detonators. These were connected in one series of six and one of eight.

The east drift was driven north 60 ft. and had three 30-ft. cross-headings, two west and one east. These headings were loaded with 60 cases of 60-per cent nitro-glycerine dynamite and 120 cases of black powder divided into nine charges, with two No. 8 detonators in each charge connected in two series of nine each.

Each charge was covered with oiled paper and tightly loaded and packed with sand. The tunnels were tightly packed with rock and at 30-ft. intervals the face of the rock was covered with sand. It was estimated that 24,229 cubic yards of rock would be broken. The actual amount broken was 26,000 cubic yards.

The hardness and toughness of the rock has made the cost of drilling and blasting excessive. At first 3¼-in. reciprocating drills were used. Then the blast-hole well-drill type was introduced.

This quarry is the only trap rock quarry at present operating in the province and was found by geologists in 1908.

The rock is a dark green type, consisting essentially of feldspar, hornblende and magnesite, which can only be distinguished with a microscope.

The rock is shipped principally to Toronto for trap rock pavement and sidewalk construction. It is used by the York Highway Commission and was used in the foundation of the new 18-story King Edward Hotel.

When the quarry was first operated 10 years ago, one No. 5 gyratory crusher was sufficient. Now the primary crushing is done by a 48-in. by 60-in. Superior jaw crusher which delivers the product to a No. 8, two No. 6's and three No. 4 crushers, which are operated in conjunction with 6-ft. and 4-ft. revolving screens.

Geo. W. Rayner, vice-president and general manager was in charge of the blasting operations.

Gypsum Industry in Texas

RESEARCHES conducted under the direction of the Texas Chamber of Commerce have revealed that the gypsum industry in Texas has assumed considerable proportions and that it offers a field for much greater development. During the past few years Texas has produced an average of about 200,000 tons of gypsum annually, having a value of more than $1,000,000. The gypsum mined in Texas is of a high quality and is an important factor in the manufacture of certain kinds of fertilizers.

Texas ranks sixth among the states in production of gypsum and is one of the first in quantity of undeveloped deposits. One of the best defined and most valuable gypsum areas lies at the foot of the Great Plains in a broad belt running from the Red River southwest of Sweetwater. It is in this belt that the largest gypsum plants of the state are now located.

Western Seaports Compete for Idaho Phosphate Trade

THE cities of Portland, Ore., and Seattle, Wash., are becoming active competitors for the export trade in Idaho phosphate. Portland is making a great effort to control the output of this newly discovered field for water shipment, but Seattle is an active competitor and the difference of 180 miles in rail haul will not suffice to keep the rival port from getting its share of the trade. Portland, however, is losing no time. It has built special branches for handling the rock at a cost of $250,000 and has a contract with the Toyo Kisen Kaisha line of steamships for supplying the Oriental demand.

Gravel for Gravel Roads

No. 2—Geology of Sand and Gravel Formations and Why Some Gravels Are Better for Gravel Roads Than Others*

SEA GRAVELS—Along the coast, where waves carry stones and pebbles through shallow water, or cast them up at the water's edge, a variety of deposits are formed. These gravels, like those of stream beds, are subject to frequent removal and re-distribution; for shore agencies are always changing in power and direction, and shifting their attack from place to place, according to laws too complex to be briefly stated. Suffice it to say that beaches like those at Rye, Hampton and Seabrook are constructed of shingle and sand which is on its way along the shore, resting, for brief space of time, until the next severe storm gathers it up and either drags it offshore, or throws it farther inland, or carries it alongshore.

Some beaches are built seaward or "prograded"; others are eaten away and beaten landward or "retrograded." The movement is intermittent, coming again with every storm; and it is also liable to be temporarily reversed, as storms from one quarter add to the beach and storms from another quarter cut it away. Our New Hampshire beaches are being slowly retrograded. Exposed headlands are being cut back and provide the beaches with supplies of stone and sand about as fast as these are consumed or lost in the great grinding mill. So long as the gain approximately balances the loss, the beaches remain nearly fixed. But as the headlands are destroyed and supplies diminished, beaches will fail to stand up against the attack of the sea and will fall back. Or if too much beach gravel is removed from them for road construction or concrete work and the loss is not made good by the supply from natural sources, the beach may suffer heavily.

Beach gravel, as a rule, is even cleaner than river gravel, owing to the fact that large quantities of rolled stones may be cast up by the onshorendash of the breaking waves and fall on the crest of the high beach, while sand and clay, washed rather than flung forward, falls short of the beach crest and filters quickly through it. On Rye and Hampton beaches the pebbles have traveled so far in coming ashore or moving alongshore that they are very well rounded.

The reason why some of them are spherical or egg-shaped, while others are flattened discs is that some rocks, like granite, crack up into pieces with approximately equal dimensions, while others, like quartzite, may split into thin tabular pieces. A piece which is flat at first, will remain so, being lifted and washed forward and back, while one which is originally nearly cubical will be rolled in all directions and become more and more nearly spherical. The pebbles on Rye beach are noticeably discoidal, owing to the prevalence, in that district, of slaty quartzite, while those at Seabrook are generally round, owing to the presence there of granite and gabbro.

On account of the scarcity or absence of matrix, sea gravel gives trouble by failing to bind without special treatment. Its freshness also makes it abnormally hard, so that it does not quickly furnish its own matrix under traffic.

Terrace Gravels—Terraces are old flood-plains, left high above the reach of modern floods by the downcutting of a river through its valley filling. The melting back of the margin of the continental glacier, at the close of the Ice Age to positions north of the headwaters of streams caused great reductions in their volume and even greater reductions in their loads. In place of water filled with sediment, water now came only through direct rainfall; consequently the streams which had formerly been laying down sediment began to pick it up, and thus to cut down their beds. From that time to this, except where local conditions are unusual, the streams have been deepening their valleys. Where they struck ledges, they halted in their downcutting, making rapids or falls, until they found a way to right or left across softer ground and resumed their valley cutting. The vigor of this terracing is due partly to the uplift of the interior of all New England since the Ice Age, which has steepened the grades of all streams.

Terraces may occur singly, where downcutting may have been uninterrupted until

Level-crested seabeach at Seabrook, N. H., now 114 ft. above the sea

*From a recent report of the New Hampshire State Highway Commissioner, Frederic E. Everett, from investigations and study made by James W. Goldthwait, state geologist, and Wallace F. Purrington, state chemist.

the present level was reached, or in groups, like a flight of steps. Each step represents the control by a ledge somewhere downstream, while this section of the river swung broadly from side to side, until the river escaped the ledge and suddenly intrenched itself. The highest terrace is the oldest of the series, the others having developed in descending order, with the modern floodplain at the foot. The steep escarpments which form the risers in the steps, instead of being straight, are usually curved or scalloped in plan because they were trimmed by a river which swung in meanders. Shallow scars of these old oxbows often show at the foot of the terrace escarpments.

In composition, terraces exhibit all kinds of material, from coarse cobbly gravel to fine sand and even clay; for the original valley filling from which they were cut may have been a muddy lake bottom or a sandy river deposit. Only the surface of a terrace is pretty sure to be gravelly, because it is invariably a river deposit, left while the stream was cutting the terrace. Knowledge of this fact teaches caution in drawing conclusions as to the depth of gravel which may be merely a thin veneer over a deep deposit of sand. Careful field inspection and deep test pits are especially advisable in terrace deposits.

(To be continued)

Sand Settling and Sand-Settling Devices

No. 2—Standard Screen Sizes—How to Figure Areas of Settling Tanks

By Edmund Shaw
Allen Cone Co., El Paso, Texas

SIZE OF GRAIN. This may be considered the most important factor in settling. To really understand it, however, we must first get a clear idea of what size means, when applied to grains of sand. As we know, it is not practical to measure the size of grains, as this can only be done under a microscope. It is equally impractical to weigh them as this requires a very delicate balance. And both weighing and measuring would consume unreasonable time. So for practical purposes the size of grains is measured by screeens. It is considered that all grains passsing one screen and remaining on the next smaller screen in the series are of the same size.

As a matter of fact they are not at all of the same size, a thin flat grain passing the same screen opening as a round grain that may weigh many times as much. Even where the shape of the grains is the same there are great differences in weight, the largest grain weighing 2.8 times as much as the smallest in the same screen size, if the Rittinger series of screens is used. This matter will be discussed more thoroughly under classification. For the present it is enough to note the fact.

Standard Screen Sizes

Two systems of screens are now in use. The older is a series without any exact ratio between the openings of the different meshes. The screens are known by the number of holes per lineal inch, and in the medium sizes they increase by 10—20-mesh, 30-mesh, 40-mesh, etc.

In the newer system the scale first proposed by Rittinger is used. Each screen opening has twice the area of the opening in the preceding screen. The width of the opening is 1.4 times the width of the opening in the preceding screen, since 1.4 is the square root of 2. As made in this country the base from which the other screens are figured has 200 meshes to the lineal inch and the opening is 0.074 millimeter. It is usual to name the screens by the number of meshes as in the other series, and the screens run 20-mesh, 28-mesh, 35-mesh, 48-mesh, 65-mesh, 100-mesh, 150-mesh and 200-mesh. This series has been made **standard** by the American Society of Mining Engineers and the screens are known as the Tyler Standard Screens.

The following table gives the falling rate of grains, using the old system of screens, which the writer finds is still in common use in rock products industries. It is largely taken from Richards, the millimeters being converted into inches, since they can be more readily used in that form:

Table I. Mesh Sizes and Falling Rates. Rate in Inches Per Second

Mesh Size	Rate of Fastest Grain	Rate of Slowest Grain
10 to 12	8.84	5.08
12 to 14	7.44	4.48
14 to 16	6.68	4.40
16 to 18	6.28	3.92
18 to 20	5.68	3.48
20 to 24	5.32	2.88
24 to 30	4.68	2.24
30 to 40	3.60	1.60
40 to 50	2.92	1.28
50 to 60	2.44	1.04
60 to 80	2.08	.68
80 to 100	1.40	.36
100 to 120	.96	.23
120 to 140	.80	.21

No average rate of fall is given, but it is stated that the rate of the average grain lies about two-thirds of the way from the slowest to the fastest grain.

These figures have been obtained from a long series of experiments and are correct so far as experimental work goes. But they are rather fast for practical work, and in figuring settling areas and the like it is well to discount them from 10 to 20 per cent.

The writer uses the Rittenger series (the Tyler standard screens), in his work, and has a simple rule for keeping in mind the falling rate of the various sizes. This rule is: Take the falling rate of 65 mesh (average grain) as 1; for sizes greater than 65 the rate increases as 1 is to 1.4, the same ratio as that of the width of the screen openings. For sizes smaller than 65 the rate decreases as 1.4 is to 1.

This rule is applicable to 20-mesh and finer grains, which are most often met with in every day work. Forming a table from this rule, we have:

Table II. Falling Rate of Grains. Sizes Same as Tyler Standard Screens

Meshes Per Lineal Inch	Diameter of Grain in Millimeters	Falling Rate in Inches Per Second
20	0.833	3.90
28	0.589	2.80
35	0.417	2.00
48	0.295	1.40
65	0.208	1.00
100	0.147	.66
150	0.104	.41
200	0.074	.25

For sizes greater than 20-mesh the rate of fall may be calculated by the formula known as Rittinger's Parabolic Formula. One way of stating it is:

$$\text{Velocity of fall} = 2.44\sqrt{\text{Dia. (Sp. Gr.} - 1)}$$

The diameter of the grain must be in *meters* and the falling rate will be obtained in inches. The specific gravity is that of the mineral of which the grain is composed. The formula is fairly correct for the falling rate of large grains, but is not correct for the smaller grains, and hence it is of little use in figuring settling areas and the like.

How to Figure Areas of Settling Tanks

Having gone thus far, the reader may perhaps wish to know the practical advantage of knowing these things. To illustrate it we will take about the simplest calculation involving falling rates, the building of a settling box or silo for catching sand.

We will assume that we have a flow of 1,000 g.p.m. and we will further assume that we want to retain sand coarser than 100-mesh. We will design the box in the simplest way, letting the feed enter through

a spout so that the stream will spread out throughout the box, rising to a rim overflow with a uniform upward current.

Any particles having a falling rate greater than the velocity of this upward current will fall in it and remain in the box. Particles having a falling rate less than the upward velocity of this current will be carried along with it and sent out with the overflow.

What we want to find then is the area which will give us the correct velocity of rising current to throw out sands 100-mesh and finer.

We have 1000 g.p.m., which is 231,000 cubic inches per minute. This is 3850 cubic inches per second. Looking up the falling rate of 100-mesh grains in Table II we find it to be 0.66 inches per second.

Dividing 3850 by 0.66 we have 5833.3 as the required area in square inches to give an upward velocity of 0.66 inches per second. This is about 40.5 square feet. Hence we may make our box about 6½ x 6½ feet, or a little bigger than 8 x 5 feet.

Notice we have taken the falling rate of a grain the full size of the mesh. This means that many grains coarser than 100-mesh will be thrown into the overflow, for reasons to be explained in the next section.

If we want to retain these grains we must use a larger settler, basing the area and upward flow on the rate of the *slowest* grain. We note from Table I that the slowest rate for 100-mesh grains is 0.36 inches per second. Dividing 3850 by 0.36 instead of 0.66 we have 10,694 square inches as the required area, which is a little over 74 square feet. This size of settler will catch practically all grains that will remain on a 100-mesh screen.

The above calculation does not take into account certain factors that the engineer might well consider if he were designing a plant. It is merely given there to show the use of the tables of falling rates.

Shape of the Grain—It will be noticed that there is a great difference in the falling rate for fastest and slowest grains given in Table I. A part of this difference is explained in the paragraphs on screen sizes, showing how greatly grains of the same shape may vary in the same mesh size.

Three shapes of grain are usually recognized, well-rounded grains, average grains and flat, scaley grains. A magnifying glass will enable one to pick specimens of each from almost any handful of sand.

It is easy to see how the shape of the grain affects the falling rate. The well-rounded, plump grains fall straight through the water, while the flat, scaley grains turn over and over or fall with a zig-zag motion, which causes them to consume a much longer time.

For this reason we find "oversize" particles, so-called, in the overflow of any settling device and "undersize" particles in the settled product. Take, for example, the settling box just figured. It is supposed to settle all grains coarser than 100. Actually there will be grains two or three sizes greater than 100 passing into the overflow. They are principally the flat, scaley grains which *weigh less* than the average 100-mesh grain. The rising current sends them up, but the screen, which measures only the diameter of the grain, retains them in the larger size. To illustrate by an exaggerated comparison, a book and a sheet of paper might pass the same opening and yet the book might weigh a thousand times as much as the sheet of paper.

Crowding of the Grains—The effect of crowding the grains in settling may be illustrated by throwing a handful of sand into a basin full of water, and afterwards allowing the sand to trickle into the basin, a few grains at a time. The handful of sand will fall to the bottom in a mass almost as if it were a solid body, while the grains fed slowly fall each at its own falling rate.

A peculiar phenomenon may be observed when sand is fed into a sorting tube containing a uniform rising current. If the tube is made of glass it will be noticed that grains which are of the right weight to balance in the current without sinking or rising will collect in the tube until it contains a mass of dancing grains. When grains enough have collected the mass acts as a plug and is entirely expelled by the force of the rising current.

Writers on settling recognize two kinds, free settling and hindered settling. The former occurs where the grains are not crowded and fall without interfering with one another. In hindered settling the grains are so crowded that they form a "teetering" or dancing mass of particles. In such a mass the grains will stratify, the largest grains going to the bottom and the smallest remaining at the top of the mass. "Jigging", which is the principal process in coal washing, and which is largely used in ore dressing, depends upon hindered settling for its results.

Porosity—Many mineral particles are not solid but have openings included in their mass. If such openings are present the grains will fall much more slowly than if they were solid.

All minerals contain more or less of porous particles when crushed, but some are much more porous than others. In working with phosphate rock in the Tennessee field the writer found grains which were very porous indeed. Some grains were examined which were almost as light as pumice stone. This porosity gives the grains an apparent specific gravity much less than that of the pure mineral without any pores, and the falling rate is considerably less than that indicated by the size of the grain.

Allied to porosity is another condition which some minerals possess, that of retaining air bubbles on the surface of the grains. Naturally this retards the settling rate. If the grains are very fine and plenty of air is introduced and the mixture well agitated enough air bubbles will stick to the grains so that they will rise and form a mineral bearing froth on the surface of the liquid. This is the foundation of the flotation process which has so widely come into use in ore dressing in recent years.

The next number of this series will treat of the forms of settling apparatus.

(To be continued)

The Cause of Most Failures

SIX out of every 10 concerns that start in business are sure to die within 30 years. Most succumb in the first 8 or 10 years. While some of this is accounted for by unwise credits, extravagance, fraud and the like, the bulk is caused by the lack of accurate, adequate and complete information relative to costs and profits. The up-to-date executive needs fresh, immediate, live data covering the exact condition of his business at all times, arranged so as to place before him all the facts, subordinated according to their relative bearing on net earnings, and do so with the least demand on his time.

Every industry needs a basic uniform cost system, which can be applied to the industry as a whole, so that the same items will be included when meetings are held to discuss certain elements of cost. Cost keeping can be made very simple. Many cost accountants design elaborate systems, expensive to install and maintain, for the purpose either of increasing their remuneration or of making work for some printer of forms. Association cost systems avoid these objections and are, in most cases, surprisingly simple to install and maintain. The firm who has good cost records is in a position to secure the confidence of his banker in the best possible way. Your banker expects an inventory of your business at cost prices and he looks with suspicion on figures not backed up by systematic records. —*"Illinois Concrete Aggregate Association Weekly Bulletin."*

Illinois House Passes $60,000,000 Road Appropriations

THE house of the Illinois legislature, on June 8, 1921, passed bills for road construction carrying a total of more than $60,000,000.

One appropriation of $5,000,000 is set aside for the construction of a cement plant. The bill to meet a similar figure from the federal treasury carries $20,000,000. There was a bill for $3,500,000 for a secondary road system that is to come from the proposed cent-per-gallon tax on gasoline.

Thirty millions is appropriated from the $60,000,000 bond issue for the pending hard roads program and the last bill appropriates $3,000,000 for the maintenance of hard roads already constructed.

A Pioneer Ohio Silica Plant

Everhard Company at Massillon, Ohio, Organized Prior to 1840, Produces Sand for Acid Open-Hearth Furnaces, Steel Molding and Glass Manufacture

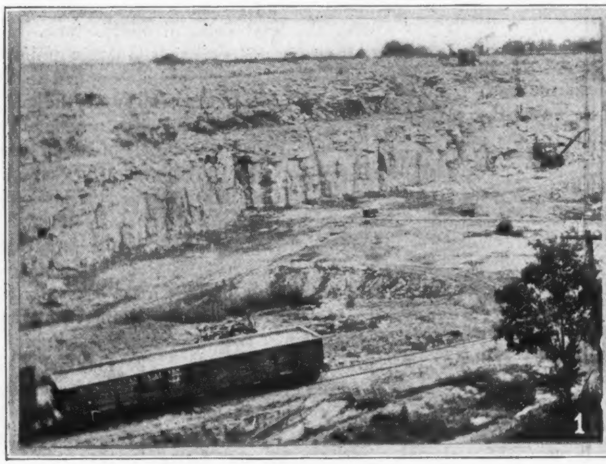
LOCATED IN THE HEART of one of the best silica producing centers in the country is the Everhard Co., at Massillon, Ohio, which has the distinction of being the first company in this country to produce silica sand for foundry use.

In 1866, the organization which was then known as the Warthorst Co., operated its quarry for the manufacture of grindstones, and in this industry it had a nation-wide reputation, because of the abrasive qualities of the rock. Besides producing grindstones the company sold considerable rock to the foundries about Pittsburgh, which at that time crushed the rock themselves, and also ground and prepared it for foundry use right at the plant.

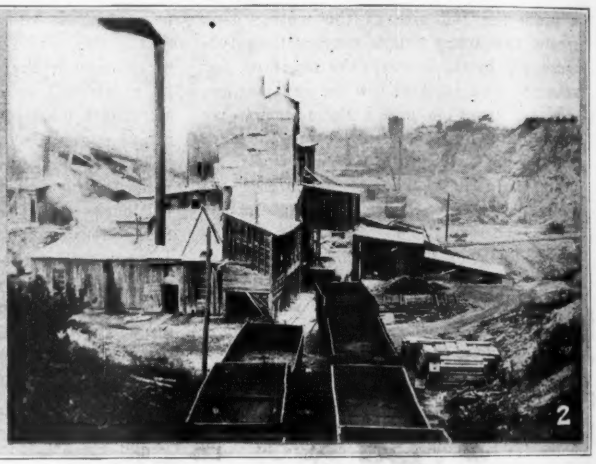
H. H. Everhard, who was at that time president of the company, conceived the idea that the tailings of the grindstones produced might be utilized by crushing and grinding them, and selling direct to the foundries for immediate use. At that time, the principal source of material for the silica plant came from blocks and slabs broken in the handling or cutting process of the grindstones. As time went on, however, the demand for prepared silica sand increased enormously and then the product of the quarry was used only for the manufacture of silica sand. In this way it came about that the first silica sand plant in the country was built; and the foundries gradually discontinued the preparation of the silica rock at their own plants, and bought the manufactured material instead.

As stated, the quarry is located in one of the finest silica districts of Ohio. The rock is in a hillside formation. This quarry, which is one of the largest in Ohio, is being worked in two benches and the quarry face is fully one-half mile in length. The first bench is 30 ft. high, and the second 40 ft. As the best grade of rock comes from the second bench, the heaviest blasts occur there. The company has still 40 more acres of land, that has not been quarried.

The deposit of rock in this quarry contains fully 10 ft. of overburden, consisting of dirt, sandy clay and loose rock. A complete operating unit is used in removing this overburden, as the accompanying views will show. A 30-ton steam shovel with a 1-yd. dipper strips the overburden and loads it into side-dump cars having a capacity of one yard. Then these cars are hauled to the dumping pile by a gasoline locomotive. Because of the number of years that the quarry has been worked, the stripping operations have become very extensive and involve a good deal of time and expense.



1—Quarry, showing three benches



2—Plant; old quarry in distance; cars for loading

Properties of a Furnace Sand

A fire or furnace sand, as used in acid open-hearth furnaces, should be a sand of highly refractory silica, and should have a sharp middling coarse grain. It must be evenly ground and pure enough to withstand the highest heat and also tough and hard enough to withstand the scouring action of an open-hearth furnace, and still have just enough fluxing ingredients to cause it to set within a reasonable time (about 30 min.) after being introduced in the furnace. The fluxing material should be preferably aluminum and iron oxide, ranging from 1½ to 2 per cent.

The sand as used in furnace bottoms forms no part or ingredient of the steel itself, but is merely what the name would imply—a bottom for the furnace. Most acid furnaces are heated by gas, either natural or artificial, while some use fuel oil. The construction of an acid steel furnace is a very elaborate and highly technical matter, and the bottom or floor upon which the steel is melted must be built up of silica sand; the sand used must have, as stated before, the "guts" to withstand the intense heat of the furnace.

When the heat in the furnace or rather the "charge" has been brought up to the proper point, according to the judgment of the operator, the tap-holes of the furnace are thrust open and the entire charge is allowed to flow by gravity to a huge vat or ladle, from which it is elevated by a crane and poured into the various molds, which are prepared to receive it. From the above it can be readily seen that the sand used in the bottom of a furnace must be sufficiently refractory to withstand the intense heat of the furnace.

All of these requirements are more than met by the sand produced by the Everhard Co. An authentic analysis of the rock showed the following results:

Silica ($Si O_2$)	97.63%
Alumina and ferric oxide ($Al_2 O_3$ $Fe_2 O_3$)	1.91%
Calcium Carbonate ($Ca CO_3$)	1.6 %
Magnesium Carbonate ($Mg CO_3$)	0.11%

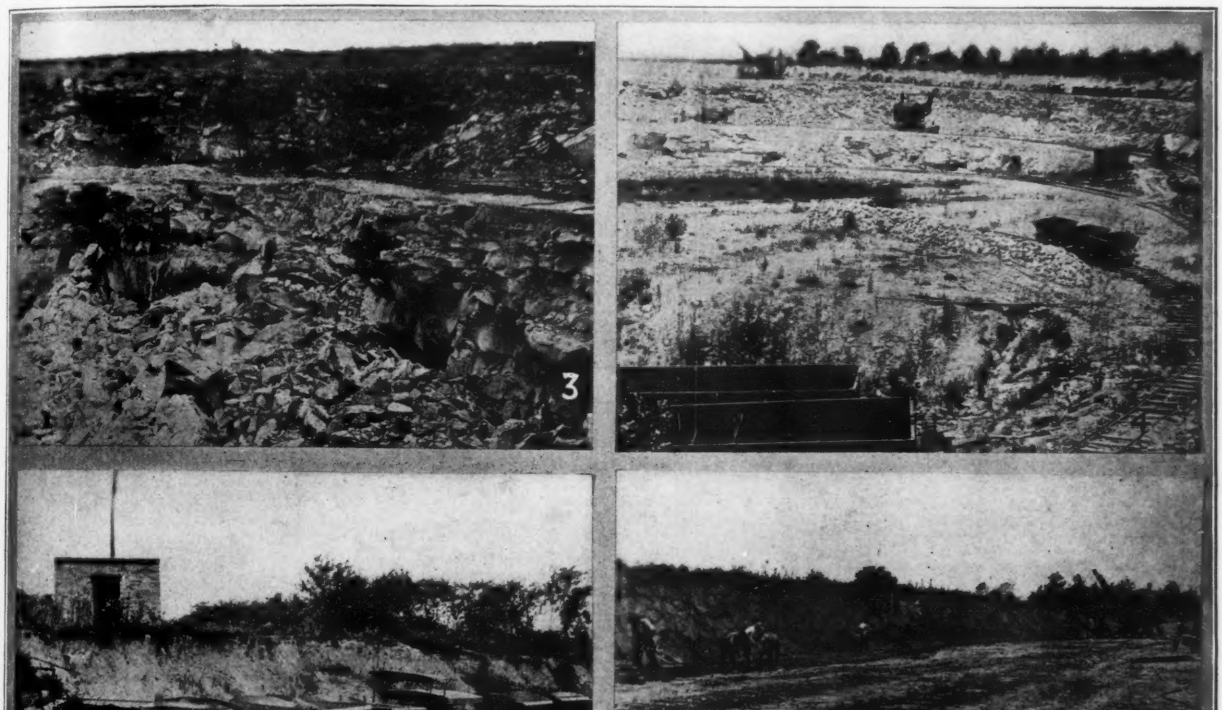
The sand when finished is a clean white and yellowish color, and because of the

fact that it is so high in silica, it is also sold for steel molding sand. It has no bond, and in order to make a mold with it, a small quantity of fire clay, molasses water, and other material is added for the binder in the foundry. As different work requires particular sizes of grain, the company can produce any specified size required. Tests of this sand have indicated that it will not fuse under 3,265 degrees Fahrenheit.

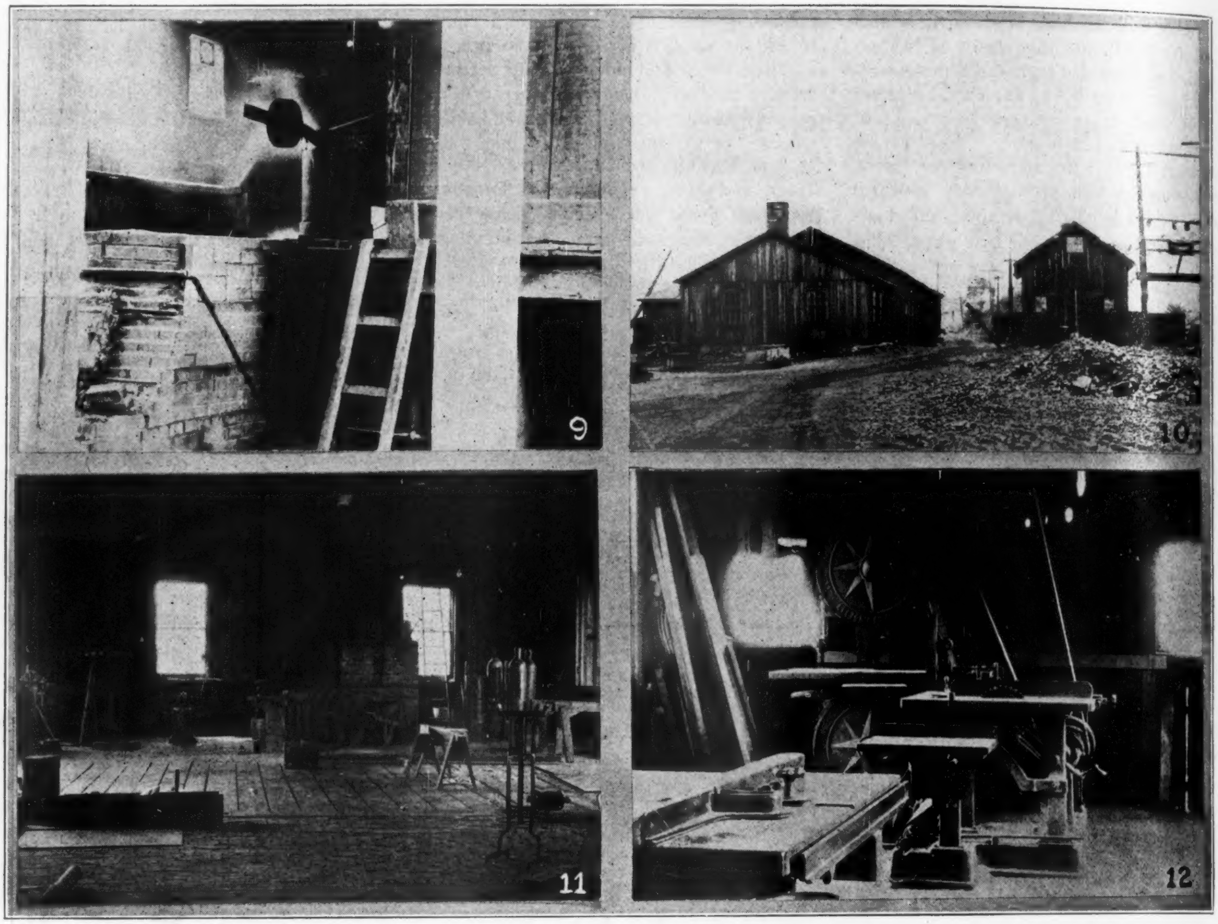
Again, because of the high silica content of the sand, it is also sold for glass sand, for which the company finds a considerable market. In preceding years the company produced a total of about 50,000 tons of the various kinds of sands, and the sand was shipped all over the United States, and even exported into Canada. Last year there was even a greater demand for this sand than the previous year, but because of priority orders and the general condition of the railroads, it was not possible to equal the 1919 tonnage.

Quarry Operation

Drilling is done with one well drill which makes a 5-in. hole. Sufficient dynamite is placed in these holes to blow the stone entirely out of place and to break it up considerably in one operation instead of just dislocating the stone and pop-shooting the boulders.



3—Result of a recent shot. 4—Another view of quarry. 5—Plymouth gasoline locomotive and cars on third bench. Note amount of overburden. 6—Removing overburden. 7—Loading stone in quarry. 8—Side view of plant showing incline from quarry



9—Gas producer. 10—Machine and pattern shop building. 11—Forge and acetylene welding outfit. 12—Band saw and circular saw in pattern shop

On the first bench a 30-ton steam shovel with a 1-yd. dipper is used to load the stone in 2-yd. side-dump cars. Since the stone is considerably broken up and well separated from the ledge, this light shovel operates quickly and effectively. A 3-ton gasoline locomotive hauls a train of three cars to the crusher hopper. This haul is made on tracks which are on the same level as the crusher hopper, and is about one-half mile in length.

On the quarry floor a 40-ton steam shovel with a dipper of 1¾-yd. capacity is used to load the stone into 2-yd. end-dump cars. The haul to the incline where the cars are hauled up to the crusher hopper and tipped automatically is made by a mule, although the car pulls the mule more than the mule the car, for the car goes down almost all the way by gravity. The cars are hauled up the incline by a cable operating on an electric hoist.

Crushing Plant

Two No. 5 jaw crushers are mounted below the hopper, so that the rock falls into both crushers simultaneously. The crushed rock then falls into another hopper and here it is taken up by an 11x6-in. pan conveyor and elevated to the hopper feeding the rolls, or re-crushers. Two sets of 18x24-in. rolls are used, and these rolls are so mounted that one is beneath the other. The material entering one roll is crushed and immediately falls to the roll beneath where it is re-crushed. From the second roll the material falls into a bin, where it is taken up by an 11x6-in. pan conveyor and elevated for passage to the dryers.

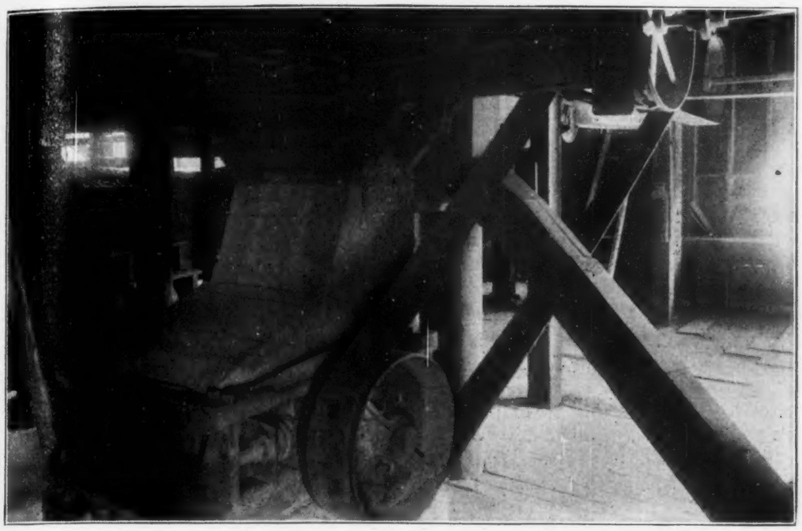
Dryers and Gas Producer

The dryers, of which there are two, are of the rotary type, about 4 ft. in diameter and 16 ft. long, having a pitch of about four per cent. These dryers are run by a set of bevel and spur gears from the line shafting and are operated under normal conditions at about 20 r. p. m.

The dryers are fired by producer gas generated in an adjoining building, but it is only necessary to convey the gas a distance of about 15 ft. Gas is admitted to the dryers through underground tunnels and into ports under the dryer. The ports are lined with fire brick and a temperature of about 150 to 200 degrees is maintained. The company has used coke and natural gas as fuel for the dryers, but experience has proved that producer gas is most efficient. For every ton of sand produced, about 13 lbs. of coal is used in the producer, which is of simple construction and built by the sand company itself.

As the hot sand comes from the dryers, it falls into a pit and here it is taken up by an 11x6-in. pan conveyor and elevated to the top of the mill, where the gravity screens are located. The screens are about 3 ft. wide and 7 ft. 3 in. long and two screens are placed in a trough side by side. The screens used are 10, 8, 5, and 2-mesh. The product of the 10-mesh is glass sand; 8 and 5 is known as steel molding sand, and 2-mesh is acid open-hearth furnace sand.

The sand that passes through the screen goes by gravity to a bin of 50 tons capacity, and the cars are loaded from underneath this bin. The tailings from the screen go to a set of two finishing rolls and the above operations described are again repeated excepting that the sand does not go through the dryers again.



Enclosed crushing rolls. Note flues for dust recovery

pert mechanic, who is responsible for the repair of machinery at all times.

Besides the machine shop which is so thoroughly equipped with two engine lathes, power shears, threading and tapping machines, power cut-off saw, keyseater, and radial drill, there is a complete set of two oxy-acetylene welding outfits. Adjoining the machine shop is a well-equipped blacksmith shop and a storeroom, where all spare parts and supplies are kept in a systematic manner; that is, shelves and sections are provided so that each part is found by a number. Here there are shelves for the storage of patterns of the company's special machinery. The machinery here is all belt driven from a line shaft by a 50-h.p. electric motor.

Opposite the machine shop is a carpenter and pattern shop, which is also a complete department in itself. Here all the wood patterns are made and also any other work needing the services of a carpenter. The interior views show the fine equipment here.

As the sand is dried, considerable dust comes up, which contains all the impurities of the sand. A complete re-claiming system has been installed to recover these impurities, which are sold for use in stucco work and for cores in malleable iron work. A set of three (40-in.) exhaust fans operates through a system of 15-in. pipes, which are placed in the dryers and all other advantageous points, where the dust may be re-claimed, and the suction produced by the fans deposits the material into bins, where it is bagged and sold for use.

Machine Shop

The extensive scope of operation of the Everhard Co., which also runs a shale brick plant adjoining the silica plant, has made it possible for them to build up a complete and separate repair department. This department is run by an ex-

Head end of dryer showing main gas producer line

Sturtevant fans for dust recovery

The mill is driven by a large steam engine, four-valve type, excepting where motors are used for driving separate units, such as the incline hoist, and pumps for supplying water for the boilers and draining the quarry pit.

The company is located on the main line of the Pennsylvania Railroad, and does most of its shipping over that line. However, it has also switching connections with the Baltimore & Ohio and Wabash railroads.

The capacity of the plant when running full is approximately 300 tons per 10-hr. day, but is well-equipped to operate over-time thus increasing the capacity.

M. M. Everhard is president and general manager of the company; Z. T. Shoemaker, vice-president; H. T. Yost, secretary and treasurer, and Otto Borr, superintendent.

Ancient and Modern Lime Mortar

Ancient Mortars Better Only Because They Were Richer in Lime—Effect of Clay

WE HAVE HAD THE OLD ADAGE handed down from generation to generation that the ancients possessed secrets in the manipulation of mortars that produced a product far superior to anything we have at the present time. Unfortunately we in this country do not have at hand these old mortars to test and compare with our modern products. We must therefore depend upon tests made in European countries for our data.

The following article by W. J. Dibdin, F. I. C., F. C. S., published in the January number of the Transactions of the Faraday Society is certainly encouraging to present-day manufacturers of lime.

To contractors, builders, and architects, it is interesting to note that such a noted builder as Sir Christopher Wren of England either had his troubles in getting satisfactory building materials, or was inclined to shut his eyes when supervising a project.

Many times the modern contractor is perplexed by the same problems that confronted the builders in ancient times, i.e., that he must make best use of the building materials at hand rather than pick and choose.

The comparison between ancient and modern mortars presents many points of interest, amongst which may be more particularly mentioned the quantity of lime used in proportion to the quantity of aggregate, the character of the aggregate, and the presence of clay. The quantity of soluble silica in some mortars has been quoted as proof of the action of the lime on the flint (silica) in the aggregate, but as will be seen later on, this is entirely fallacious. The strength of certain old mortars has been quoted as if the users possessed methods the art of which has been lost, but there is no evidence that such is the case, as properly compounded modern mortars will within a reasonable time possess strength equal to the best old samples obtainable.

The work carried out by the author for the Science Committee of the Royal Institute of British Architects during the years 1907-8-9-10 following a paper read by him before that institute in December, 1916, on "The Composition and Strength of Mortars," brought to light many points which had hitherto been but vaguely dealt with.

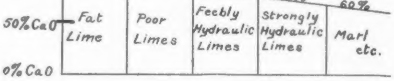
Quantity of Lime Used

An important point is that relating to the quantity of lime used. It appears a simple statement to say "1 to 3," i.e., one volume of lime to three of sand. In practice this appears to have been read in different ways. In some instances, the volume of lime is measured as dry unslaked lime as received from the kiln. In others, the lime has been first "dry-slaked" and the required quantity taken from the powdery mass, which has a volume per unit weight of unslaked lime considerably greater than that originally.

In some cases the slaked lime is first made into a "putty," kept for a time, and then measured in that condition. For instance, in one case 1 cu. ft. of unslaked lime, after slaking, equalled 1.53 cu. ft., and in another the cubic foot was increased to 1.77, while still greater variations have been observed.

Hence, all statements of proportions of lime to aggregate are generally given in terms of *unslaked* lime, and in stating the results of analyses of mortar the volume of lime is calculated from the percentage of pure CaO on the assumption that the original lime was comparable to a commercial lime containing 80 per cent CaO, and multiplying the weight so found by 2⅓, to correct *weight* to *volume*. This is necessarily an arbitrary rule, but it is the only one available, and serves for practical purposes in the absence of definite information.

The variation in the qualities of various limes may be diagrammatically shown thus:



Proportion of Lime in Ancient Mortar

The analysis of a series of ancient mortars collected for the purpose of the investigation above referred to, by members of the Royal Institute of British Architects and others, the result of which are given at length in the report to the Science Committee of the Institute, showed that the volume of aggregate to one volume of lime varied from 0.4 to 3.7, but in only four instances out of 26 was it more than two, the average of these being about one as compared with the modern practice of three.

The best result of a large number of mortars prepared for experimental purposes and kept two years before being tested for crushing and tensile strengths showed, out of 15 samples, that 11 contained 2.0 to 2.5 of aggregate to one of lime. Unfortunately, tests with one to one were not made. It will therefore be seen that in the matter of relative volume the ancient mortars contained *larger quantities of lime* than is considered permissible in modern practice.

Nature of Aggregate

Modern specifications for the aggregate to be used for mortar generally state that this is to be "clean," washed sand, etc. On turning to the results of the analyses of ancient mortars of the twelfth and thirteenth centuries, and that of the London Wall, we find that the proportion of aggregate was not only less, but its character was largely that of gravelly sand with clean ferruginous clay, the quantity of the clay varying up to as much as 19.5 per cent of the aggregate.

The samples of mortar from Allington Castle, early thirteenth century, collected by W. D. Caroe, F. R. I. B. A., were particularly interesting. The relative proportions of lime to sand, etc., in three samples were 1 to 1.7, 1.1 and 1 to 1.9, the observations of Mr. Caroe when sending them being respectively, "Very good, indeed," "Not so good as *A*, but fair," and "In fair condition." The percentage of clean ferruginous clay was respectively 8.6, 3.66, and 4.0 per cent of the sand, which was fairly coarse, the proportions of coarse sand retained on a ¼-in. mesh being 20, 22 and 12 per cent, respectively.

The crushing strength of the first of the three samples was as high as 144 lbs. per sq. in., and that of the second 90 lbs. Two other samples from the same building contained lime in the proportions of 1 to 1 and 1 to 1.3; clean red clay in the proportion of 4.5 and 5.7 per cent of the aggregate, respectively, the crushing strength being 162 lbs. and 194 lbs. per sq. in., respectively.

Two samples of Roman mortar, viz., from the Pharos, Dover, and a Roman villa at Darenth, contained clean lime and broken brick only; whilst another from Threlfall Castle, near Hythe, contained clean flint and pebbles for the aggregate.

Thus we see that there was no systematic method in the preparation of these early mortars, evidently materials most conveniently obtainable being employed; preference, however, being given to clean ferruginous, clayey, gravelly sand when obtainable.

As showing the character of some of the mortar used after the Fire of London, a sample from Painters' Hall, Trinity Lane, is interesting. This was built by Sir Christopher Wren, who evidently had little time to look after details. The sample was collected by H. D. Searles-Wood, F. R. I. B. A., and was found to contain lime and grit in the proportion of 1.0 to 0.5. There can be little doubt that a good proportion of this lime was due to the use of old mortar for aggregate. It was unequally mixed, and contained lumps of lime, some soft and

some hard, the "sand and grit" consisting of broken red brick and organic debris, evidently old rubbish from the ruins of the fire, the "earthly matter," clay, etc., in the grit being no less than 15.4 per cent. In this case the crushing strength was 110 lbs. per sq. in.

Tests of Modern Lime Mortar

In comparison with these results, we may now turn to the best results obtained with experimental samples of mortar made with known materials and in proportions of lime to aggregate varying from 1 to 2 up to 1 to 5 and tested after being kept for two years.

White chalk lime gave the best results—

	Ratio	Lbs. per Sq. In.
with Standard Leighton Buzzard sand	1—3	240
with fine Charlton sand	1—2	300
with pit sand	1—2	247
with Thames sand	1—2	297
with ground brick	1—3	312

Dorking greystone lime gave the best results—

with Standard Leighton Buzzard sand	1—2	257
with Charlton fine sand	1—5	180
with pit sand	1—2	333
with Thames sand	1—2	243
with ground brick	1—3	162

Blue lias lime gave the best results—

with Standard Leighton Buzzard sand	1—2	538
with Charlton fine sand	1—2	257
with pit sand	1—3	650
with Thames sand	1—2	297
with ground brick	1—2	910

These results show distinctly the reason of the advantage gained by the early builders in fixing their ratio at about 1 to 2 and the use of a coarser aggregate, as we have seen. The modern rush after economy, by reducing the quantity of lime, is very largely responsible for the falling off in quality of the mortar.

Effect of Clay

With regard to the presence of clay in the "sand grit," this has received attention. Unfortunately, the experiments were made with ratio of 1 to 3 in all cases, so that results do not compare with the foregoing but as comparable tests were made with and without the addition of five per cent Red London clay, they are not without interest.

Under other conditions, the use of clay is distinctly advantageous. For instance, greystone lime and standard sand were used in varying proportions and the blocks crushed at the end of one month, with the following results:

Ratio 1 to 3.	Crushing Strength in Lbs. per Sq. In. Without Clay	With 5% London Clay
White chalk lime and standard sand	240	230
White chalk lime and fine Charlton sand	260	70
White chalk lime and pit sand	253	163
Dorking greystone lime and standard sand	228	177
Dorking greystone lime and fine Charlton sand	140	82
Dorking greystone lime and pit sand	200	140
Blue lias lime and standard sand	138	876
Blue lias lime and fine Charlton sand	156	79
Blue lias lime and pit sand	650	550

	Crushing Strength in Lbs. per Sq. In.
Standard sand without clay 5 vols., lime 1 vol.	42
Standard sand plus 2½% clay, 5 vols., lime 1 vol.	74
Standard sand plus 5% clay, 5 vols., lime 1 vol.	128
Standard sand plus 7½% clay, 5 vols., lime 1 vol.	183
Standard sand plus 10% clay, 5 vols., lime 1 vol.	176
Standard sand plus 10% clay, 2 vols., lime 1 vol.	223
Lewisham fine sand and natural clay 3 vol., lime 1 vol.	154
Lewisham fine sand washed free from clay 3 vol., lime 1 vol.	33

From these results it will be seen that the use of clay when the proportion of matrix to aggregate is 1 to 3 is disadvantageous with white chalk lime and greystone lime, but with blue lias lime a marked improvement is obtained with the standard sand.

Voids in Aggregate

An essential factor in regard to the strength of mortar is that relating to the voids, or empty spaces, between the particles. In the case of a mortar made with a sand having 40 per cent of voids, the crushing strength was found to be only 70 lbs. per sq. in., whilst with a sand having only 23 per cent of voids the crushing strength was 154 lbs. This explains why the proportion of lime, when used with coarse sand, should be in a greater ratio than 1 to 3, 1 to 2 giving far better results.

The suggestion that soluble silicates are formed in the course of time is not borne out in the author's experience. As a test case, a mortar was made with pure lime and clean sand treated with hydrochloric acid, and thoroughly washed. After twelve months it was carefully examined for soluble silica, when not a trace was present. The examination of numerous samples of ancient mortar revealed the presence of no more soluble silica than is normally found in ordinary fresh-made mortar. For instance, the mortar from the Roman Wall, London, contained only 0.30 per cent; those from Allington Castle, twelfth and thirteenth centuries, only 1.20, 0.70, 1.00, 0.42, 0.84 and 0.68, respectively, and that from the Pharos, Dover, only 0.30 per cent. Certain cases are met with in which soluble silica is much higher, as at Pembrey Castle, Caermarthen, thirteenth century, where the soluble silica was as much as 2.95 per cent, and the core of the old wall at Crosby Hall, where 3.8 per cent was found. Much higher results have been obtained, but in such instances the character of the mortar leads to the conclusion that trass or pozzuolan, etc., had been employed.

The setting of mortar was ascribed by Graham to the fact that "on drying, the mortar binds the stones between which it is interposed, and its own particles cohere so as to form a hard mass solely by the attraction of aggregation, for no chemical combination takes place between the lime and the sand, and the stones are simply united as two pieces of wood are by glue." "From the minute division of the silica and alumina in hydraulic mortar, their combination with lime is more likely to occur than in ordinary mortar. Still, the fixing of the hydraulic mortar seems to be chiefly due to the fixation of the water and formation of a solid hydrate like gypsum." This view entirely agrees with my own experiments, as recited shortly in the foregoing, and I have no doubt that the process of crystallization acts largely in connection with the "setting" of mortar and cement, assisted by aggregation.

Conditions in Lehigh Valley Cement Districts

THE SITUATION in the Lehigh Valley section of Pennsylvania remains practically unchanged at the different cement mills. As set forth in the last issue of ROCK PRODUCTS, there is a good supply of material on hand in this district at the present time, and under weakened call, the general tendency is towards curtailment in output. This is leading to a reduced working schedule at a number of the mills, while other plants are letting employes go. There is a good available supply of labor in these parts at the present time.

Minor operations have been under way at a few mills, preliminary to a more stable condition of cement manufacture. The Coplay Cement Mfg. Co. is completing the grinding of a supply of clinkers on hand at its Mill C, and it is generally expected that following this work the plant will resume manufacture on a near-normal basis. The Atlas Portland Cement Co., the Lehigh Portland Cement Co. and the Alpha Portland Cement Co. are maintaining fair production at their different operating plants. The Allentown Portland Cement Co. has resumed operations at its Evansville, Pa., plant after a two-weeks' shutdown and is maintaining fair production.

The Lehigh company has inaugurated a "No-Accident Month" campaign at its different mills throughout the country, and those in the Lehigh Valley section are taking on the safety drive in an encouraging manner. Major H. A. Reninger, in charge of the safety movement at the various plants, opened the drive at the West Coplay mill of the company on June 5, with an audience composed not only of operatives at the plant, but their families and other people in the town. The mill organization showing the best accident record at the end of June will receive a suitable reward.

Delegates to the convention of the American Order of Steam Engineers at Allentown, Pa., visited the large mill of the Atlas Portland Cement Co. at Northampton, on June 9, as guests of the company.

Practical Chemistry for Lime and Cement Manufacturers

Calcium Hydroxide (Hydrate)—Lime and Limestone—Uses of Lime

By Richard K. Meade, M. S.
Consulting Chemical and Industrial Engineer, 11-13 Fayette Street, Baltimore, Md.

CALCIUM HYDROXIDE or hydrate is formed when calcium oxide is acted upon with water, or in other words when lime slakes. The reaction which takes place is as follows:

$$CaO+H_2O=Ca(OH)_2$$

Calcium hydroxide is a fine powder occupying a much larger volume than the lime from which it was made. This swelling of lime in slaking is the cause of pitting or blowing in plaster work and of the "unsoundness" of cement. If lime plaster contains calcium oxide, when applied in the wall, the latter will in time slake, often after the plaster has hardened, and in slaking will expand. If it is surrounded by fully hardened plaster, the effect of this swelling will be to push away the plaster, causing blowing or pitting in the wall.

Similarly, if cement contains much free calcium oxide (i. e., calcium oxide not combined with other compounds such as silica), this will hydrate after the concrete has hardened causing the breaking up or disintegration of this. In the case of cement, the action is much more marked than with lime because each tiny particle of unsound cement will contain some free calcium oxide and when these tiny particles begin to hydrate the entire mass of concrete cracks, disintegrates and often literally returns to sand and gravel.

When lime hydrates much heat is developed. The actual quantity of heat liberated is 485 B.t.u. per pound of lime hydrated. The danger from fire when water reaches lime in a frame storage shed is now well understood by all lime men.

By reference to the reaction it will be seen that 56 parts of calcium oxide will take up 18 parts of water, or roughly lime will require for hydration one-third its own weight of water. When a mason slakes lime in a mortar box he adds to the contents of the latter sufficient water not only to combine with the lime, but also a considerable excess, part of this excess is evaporated by the heat liberated by the chemical reaction and part remains after the lime is slaked and forms with the slaked lime a thick paste or putty.

The heat liberated by 56 pounds of lime is sufficient to evaporate 24 pounds of water from 60°, so, if 42 pounds of water are added to 56 pounds of lime, 18 pounds of this will be absorbed by the lime forming calcium hydrate and 24 pounds will be evaporated. In this case, the calcium hydrate will remain a dry powder. The manufacture of hydrated lime proceeds along these lines. In practice the amount of water is never so large as the above because lime is never 100% calcium oxide and some heat is always lost by radiation, etc.

Lime and Limestone

Limestone, as we have said, is composed of more or less pure carbonate of lime. The principal impurities are silica, iron oxide, manganese and alumina. Mixed with the carbonate of lime is always some carbonate of magnesia, the amount varying from a trace to about 45 per cent. This carbonate of magnesia should not be considered as an impurity, however, since it is decomposed by heat, just as is carbonate of lime, into magnesia and carbon dioxide. The magnesia, which remains in the lime, confers on it certain valuable properties and increases its usefulness for some purposes. The chemical analyses of a number of limestones used for lime burning are given in Table I.

When limestone is heated to a red heat it is decomposed as we have seen and gives off its carbon dioxide leaving a residue consisting of lime and magnesia mixed with the impurities in the limestone. These impurities, as has been said, consist of silica, iron oxide, alumina and manganese. These all exert more or less influence on the properties of the lime and particularly on its color. The purer the lime is, the better, and hence the purer the limestone, the better the lime it will make. The blue and gray color usually associated with limestone are caused by the presence of organic matter in the latter. This organic matter burns when the limestone is heated and hence the color of the limestone is not often any indication of the quality of lime it will produce. Some nearly black limestones burn to a white lime. Lime always contains a much higher percentage of impurities than the limestone from which it was produced, and a limestone containing 2% of impurities will produce a lime containing over 3½% impurities.

We can very readily calculate the composition of the lime which will be produced from any limestone. The rule for doing this is based on the fact that when limestone is ignited, carbon dioxide is driven off (also carbon and sulphur if present are burned) and silica, ferric oxide, alumina, calcium oxide and magnesium oxide, being non-volatile, remain. The rule is, therefore, multiply the percentage of each non-volatile constituent by 100 and divide by the sum of the percentages of the five non-volatile constituents named above, the result will be the percentage of the desired constituent found in lime. For example—suppose we wish to calculate the composition of the lime which would be produced by the first limestone given in Table I (that from Lagarde, Ala.); the first step is to con-

TABLE I—ANALYSES OF LIMESTONES

Where Found	Silica	Ferric Oxide and Alumina	Calcium Carbonate	Magnesium Carbonate*
Lagarde, Ala.	0.62	0.36	98.36	0.65
Marblehead, Adams Co., Ill.	0.40	0.80	97.40	1.40
Rockland, Knox Co., Me.	1.08	0.16	98.10	0.08
Union Bridge, Frederick Co., Md.	0.28	0.48	97.23	2.83
Annville, Pa.	0.36	0.90	97.11	1.12
Dover Plains, Duchess Co., N. Y.	0.88	0.90	54.74	44.10
Woodville, Ohio	0.29	0.25	54.12	44.96
Cedar Hollow, Pa.	1.72	1.28	56.84	38.48
Oyster Shells	0.82	0.28	96.52	0.56

*Note—In many analyses of limestones, the carbonates of calcium and magnesium are split up into calcium oxide, magnesium oxide and carbon dioxide and instead of giving the percentages of the first two, those of the last three are given. To compare such analyses with the above, discard the carbon dioxide and multiply the percentage of calcium oxide or lime by 1.784 and the percentage of magnesium oxide or magnesia by 2.091; the result will be the corresponding percentage of carbonate of calcium and carbonate of magnesia. Similarly given the analysis expressed as in the above table to find the corresponding percentages of oxides, multiply the percentage of calcium carbonate by 0.5503 and of magnesium carbonate by 0.4782; the result will be the equivalent percentages of calcium oxide and magnesium oxide respectively.

TABLE II—ANALYES OF LIMES

Manufacturer	Silica	Iron Oxide and Alumina	Lime	Magnesia
Kelley Island Lime & Transport Co., Clay Center, Ohio	0.16	0.50	62.60	37.16
Woodville Lime & Cement Co., Woodville, Ohio	0.09	0.71	58.20	36.26
Lee Lime Co., Berkshire Co., Pa.	0.50	0.50	54.22	43.50
New York Lime Co., Natural Bridge, N. Y.	1.34	0.38	91.59	5.85
Marblehead Lime Co., Louisiana, Mo.	0.54	0.40	97.46	0.77
Palmer Lime & Cement Co., York, Pa.	0.42	0.36	97.15	1.12

vert the percentages of calcium carbonate and magnesium carbonate to calcium oxide and magnesium oxide, respectively, as indicated in the note following the table:

	Pct.
$CaO = 98.36 \times 0.5603 =$	55.11
$MgO = 0.65 \times 0.4782 =$	.32

The analysis then is

	Pct.
SiO_2	0.62
$Fe_2O_3 + Al_2O_3$	0.36
CaO	55.11
MgO	.32
Total	56.41

The balance, or 43.59 per cent, is carbon dioxide, etc., which is driven off when the limestone is burned. The compounds indicated above, however, are not volatile and remain behind. If 100 lbs. of this limestone are completely calcined, therefore, so that all the carbon dioxide is driven off, there will remain 56.41 lbs. of lime. In this 56.41 lbs. of lime there will be 0.62 lbs. of silica, or $0.62 \times 100 \div 56.41 = 1.10\%$. Similarly, the percentages of the other constituents can be worked out when the composition of the lime will be found to be

		Pct.
SiO	$= 0.62 \times 100 \div 56.41 =$	1.10
Fe_2O_3 Al_2O_3	$= 0.36 \times 100 \div 56.41 =$	0.64
CaO	$= 55.11 \times 100 \div 56.41 =$	97.70
MgO	$= 0.32 \times 100 \div 56.41 =$	.57
		100.01

Of course, in practice we do not often completely burn limestone, but usually leave in the lime one-half per cent or more of carbon dioxide. The above, however, gives a good idea of the purity of the lime which may be made from any limestone and allows the manufacturer to calculate whether the product will pass specifications. In general, it may be said that the lime will contain approximately 75 per cent more impurities than the limestone. Thus a limestone with 1.00 per cent of silica, ferric oxide and aluminum oxide combined will produce a lime containing a total 1.75 per cent of these impurities.

Table II gives the analyses of some well-known American limes. These anlyses all represent high grade lime.

Uses of Lime

Lime is employed for many purposes besides building. Among these may be mentioned its uses as a fertilizer, for water softening, for purifying coal-gas, in tanning leather, in the manufacture of sugar, wood paper-pulp, glass, calcium carbide, bleaching powder, lye and many other chemicals. For most of these purposes a high calcium lime is required, although both kinds are used for fertilizer and dolomitic lime is preferred for wood pulp manufacture. For all of these purposes the value of the lime increases with its purity and the thoroughness with which it has been burned.

The presence of very small amounts of iron oxide tends to color lime red or yellow, while manganese oxide makes it gray or black. Silica decreases the plasticity of lime and also its sand-carrying capacity, but alumina, on the other hand, increases both of these properties. When lime is to be used for building purposes other than for plaster finishing and for chemical purposes, it may contain quite a large amount of impurities and many limes find extensive local use which contain from 5 to 10 per cent impurities. Some of the lime sold locally for fertilizer is very impure, containing often only 85 per cent lime. Where lime is shipped any distance, however, it is usually quite pure.

Lime is made extensively along the Atlantic seaboard from oyster shells, which are quite free from impurities. Table I gives an analysis of oyster shells.

(To be continued)

Edward Hely, Prominent Stone Man, Dead

THE National Crushed Stone Ass'n has lost one of its dearly beloved members and an earnest and steadfast worker in

Edward Hely

the death of Edward Hely, proprietor and general manager of the Edward Hely Crushed Stone Co., Cape Girardeau, Mo. His death occurred on May 30, the result of a stroke of paralysis suffered a week previously.

Mr. Hely was born in Bloomington, Ill., November 1, 1860, and was educated in the high school at Cairo, Ill. He adopted engineering as a profession and went into railroad building where he won recognition, having been active in putting railroads through the Ozark country. Those were big jobs, the building of railroad lines through the Ozark country, but Edward Hely was a man to do big things.

Finishing his work at railroad building, Mr. Hely opened up stone quarries and crushing plants at Williford, Ark., in 1886, also at West Plains, Mo., and Black Rock, Ark. He established himself in Cape Girardeau in 1902 and opened up the Hely quarries south of the city. Through his strong personality, sterling integrity and close adherence to business, his plant soon grew into one of the largest rock product concerns in Missouri.

Mr. Hely besides operating his large stone crushing plant, which was described in the October 23, 1920, issue of ROCK PRODUCTS, was prominently identified with other concerns in his home community. He is survived by one son, Norman L. Hely, also a prominent business man of Cape Girardeau, and three sisters and one brother.

Aetna Explosives Co. Taken Over by the Hercules Powder Co.

THE Hercules Powder Co., Wilmington, Del., announces that on June 6 it officially acquired the properties, assets and business of the Aetna Explosives Co., New York, N. Y.

By this purchase the Hercules Powder Co. will acquire high explosive or dynamite plants near Birmingham, Ala.; Emporium, Pa.; Sinnamahoning, Pa.; Ishpeming, Mich., and Fayville, Ill.; two black blasting powder plants, one at Goes Station, Ohio, and the other near Birmingham, Ala.; a plant for the manufacture of electric blasting caps at Port Ewen, N. Y., and a plant for the manufacture of fulminate of mercury, for use in blasting caps, at Prescott, Ont., Can.

The company is now in a position to do business in all parts of the United States, and will be greatly strengthened in important fields which have hitherto been closed to it on account of freight rates from its plants.

California Gypsum Deposit to Be Developed

PLANS to develop about 21,000 acres of gypsum land located in San Bernardino County, California, have been perfected recently, according to a local newspaper. The locators of the land include Jeanette Brown, C. W. Parnell, F. J. Chapman, J. E. Taylor, E. W. Barbour, J. A Crowley, Harold Gooding and L M. Barbour.

The deposit is located south of Cadiz and is largely in the Cadiz dry lake. It is planned to construct a railroad line into the property from the main line of the Santa Fe and to develop the property for use as fertilizer and in plasters.

Lubrication of Sand-Lime Brick Manufacturing Plants

Principles of Good Lubrication That Apply Equally Well to Any Plant in the Rock Products Industry*

By E. N. Corbin
Vacuum Oil Co., Philadelphia, Pa.

IN PRESENTING THIS PAPER on the lubrication of the sand-lime brick plant, it seems necessary to divide the subject into two general heads. There are two essential things to be taken into consideration. One, the oil best suited for the work; the other, the methods of applying that oil. It is difficult to determine the lubricating qualities of an oil. It is easy to match what you may be using in many, or all the physical properties, but these have little bearing, in most cases, on the ability of the oil to reduce friction. You usually get the quality of oil you pay for, and no more.

Good lubricating oil made to meet a definite operating condition, must first be a carefully selected crude, and refined so as to retain its natural properties, and thereby preserve the highest qualities that have to do with the factor of correct lubrication.

The average plant owner views the question of lubrication as of small moment; it being one of the smallest items in operating costs; the purchasing agent is interested in the unit cost or price per gallon; the plant superintendent generally leaves the oiling to the department foreman, who in turn has his own troubles in other lines, while, in reality, to each of these departments, the question of correct lubrication is very vital, from his particular standpoint.

As a rule, plants of this type use the cheapest products that they can obtain—the thought being that only a cheap oil can be successfully used. The Vacuum Oil Co. has successfully used the highest grades of lubricating oils produced and obtained the best results.

What Correct Lubrication Means

More profits to the plant owner.

Less cost to the purchasing department.

Fewer shutdowns and less operating cost to the plant superintendent.

More production and less labor for the department foreman.

It is impossible for the department heads to solve all of their lubricating problems in the average plant. It is impossible for the operating man to know the nature of lubricating oils. He may find a way of applying them, but time will not permit him to study the problem to find the best methods.

Nearly all the large oil companies distributing lubricating oils have their engineers. They will study your problem, and carefully select a correct grade of oil, regardless of price, and then introduce methods whereby every drop of that oil will do 100 per cent work, with but little waste, increasing your efficiency, plant machinery life and production, and at the same time reducing the annual operating cost as effected by lubrication.

Manufacture of Lubricating Oils

In selecting the crude from which to make an oil for a definite lubricating condition, it may be interesting to note that we find oils in almost every country on the globe. During the last 70 years, since Pennsylvania gave us the first petroleum products, we have found oil in about 12 states, extending from the Atlantic to the Pacific, and from the Great Lakes to the Gulf. These oils differ greatly in their natures from Pennsylvania paraffin base crude to Oklahoma, Texas and California asphalt base oils; from a light clear oil, suitable for use in an automobile to a black heavy tar that cannot be pumped through a six- or eight-inch pipe line, except at high temperatures, and reheated every 15 or 16 miles. From this endless variety, the oil experts must select their special crudes. They must not contain too many impurities, the principal of which is sulphur. The chemist must study the distillates to know when to stop to get the proper type of oil. The finisher must know how to get the qualities required, and keep a uniform product.

Two general methods of refining crude are employed, both of which will produce lubricating oils. The one used by the refiner, whose principal products are light napthas, gasoline, and burning oils, is known as the destructive method of distillation, in which a pressure, in some cases as high as 40 pounds per square inch, is carried on the still, and the final temperature reaches as high as 1,000 degrees Fahrenheit. Such stills are large, handling from 1,500 to 2,000 bbls. of crude. The final product left in the still is tar, coke and pitch. In this process, the heavier vapors are allowed to condense on the dome of the still, and as they fall back into the hot oil the hydrocarbons are broken up, giving off more light vapor, from which to get illuminating oils. (This is called cracking.) In this process, no attention is given to the quality, or nature of the lubricating oils.

The other method is called fractional distillation, and the Vacuum Oil Co. employs a vacuum on the still. The stills are much smaller, containing about 450 bbls. of crude, and reach final temperatures of only 650 degrees or 700 degrees Fahrenheit. The vapors are not allowed to condense and fall back in the hot liquors, but are carried away to condensors. In this process gasoline and kerosene are produced, but not in large quantities, and the final products are light and heavy; neutral lubricating stocks are used for bearing oils, and the heavy cylinder oil stocks are left in the still. In this process, the different lubricating oil stocks are obtained, from which the finished oils are made. This process keeps down heat, thus retaining the high qualities of the products.

If a hundred bearings run well, there is a reason why one goes bad, or is giving trouble. It does not mean, however, that you are getting the highest lubrication efficiency if you don't burn out a bearing every day. One very often hears, "We are having no lubricating trouble."

Application

In considering the application of oil to machine and shafting bearings, keep in mind one thing, i.e., that human agencies, the ordinary laborer, cannot be depended on to correctly or consistently lubricate bearings. If they oil the bearing at all, they generally try to give it enough to last a long time, with the result that about 90 per cent of the oil used finds its way to the floor, and serving no purpose except to sell more oil for the supplying company.

The sand-lime brick plant is not what might be called an ideal lubricating problem. In fact, there are but few industries that have so severe a problem. It differs

*Paper read at the convention of the Sand-Lime Brick Association, Dayton, O., April 26, 27, 1921.

entirely from the ordinary clay brick industry, and compares more with the cement plant in that the grit and dust is everywhere present to work into, and cut out the machine bearings.

It is extremely hard to keep up the bearings in a sand-lime brick plant, and the large problem is the study of each machine and each bearing to determine how to apply the lubricant; first, to keep the grit out of the oil and bearing, and second, to always have a supporting of film present, and to eliminate the human element as far as possible.

Some simple automatic, or semi-automatic device must be applied, where conditions will admit devices that require attention only at stated intervals, and at as long periods as possible.

It is the problem of the lubrication engineer to work out a simple method that will best serve a definite condition.

Grease Versus Oil

Both grease and oil have their place in the general lubrication of a plant, but usually where there is much grit and dirt to contend with, oil will prove the most satisfactory. If oils are correctly applied, the grit will settle out, or can be filtered out, while a hard lubricant will carry it in suspension to the vital parts of the bearings. By making use of some of the well-known laws of capillary attraction (wick feed cups), oil can be applied in such proportions as are required, uniformly and continuously, which is the secret of successful lubrication.

An oil film formed of a high-grade lubricant will last almost indefinitely, if it can be maintained without waste. Therefore, if we apply just enough additional oil to make up for the unavoidable loss in a bearing, we have done all that is possible for efficient lubrication, and any amount of oil in addition to this necessary amount is waste.

Most shop shafting bearings and some few machine tools are provided with automatic oiling devices, such as the ring oil bearing, which are all right in the average manufacturing plant. This is not always the case under conditions such as exist in some parts of the sand-lime brick plant. The average ring oil box is open enough to collect sand and grit, and very often will stop the ring from turning, therefore it is not entirely dependable.

In studying the particular problem of the lubrication of sand-lime brick plants, especially at the Hummelstown Brown Stone Co.'s plant, at Waltonville, Pa., we made use of a number of different devices.

Bottle Oiler

This device is applicable to all shafting bearings where direct contact to the moving shaft can be easily secured. This simple device is very positive, and depends on the moving shaft for its action. It feeds a sparing amount of oil when the shaft is in motion, and holds the oil when there is no movement.

With proper attention, this device will feed clean oil, and eliminate grit and sand from the bearing. On large bearings, two to five cups, or bottles, may be used, as required.

This device on shafting bearings, worm screw conveyors, elevator tops, screens, dryer trunions, mixing and tempering machines, as well as on the brick press bearings, where direct shaft contact can be secured, will be found to give best results.

Wick-Feed Oil Cups

Where the bottle oiler cannot be used, due to the nature of the bearing, its location or liability of breakage of the glass bottle, the wick-feed oil cup is often used. This device is familiar to all of you, and it is only the correct application of it that we need to consider.

In most cases, where the sight feed oil cup is now employed, the wick-feed cup will give better service, and effect a saving in wear and tear, and also in oil consumption. The sight feed oil cup is not applicable to machinery in general except in the engine room and under constant attention of an attendant.

There are various applications of the wick-feed cup, especially when applied to special types of machines. From a single wick-feed cup to a group wick feed, a whole machine may be lubricated from one or two cups, requiring attention once a day or less.

At the Hummelstown Brown Stone Co. plant, the wick-feed cup is used about the brick press, on the toggles, guides, and such bearings as are reached at short lengths of feed piping. Also, for various other places where breakage is too great. The oil upon reaching the shafting is clean, even if sand gets into the oil cup, and the results obtained have been very satisfactory.

Capillary Oil Well

This type is used on heavy bearings, slow speed. This device consists of an oil well which may be placed within the bearing cap or mounted about the shaft or bearing. The oil from the well is fed to a felt distributing pad, resting on the shafting, or oil holes are arranged, using strands of yarn to candle wick for the feed. This method of application was used in replacing grease with oil at the Hummelstown Brown Stone plant.

ILLUSTRATION OF CORRECT LUBRICATION

Taking up in detail a few of the machines and applying these different devices, I will go over the equipment, in part, at the Hummelstown Brown Stone Co.'s plant.

Stone Crusher

The first machine that we must consider is the jaw crusher, 18x36-in., running at 270 r.p.m., and by no means an easy one to deal with. The machine was designed for grease lubrication, but with grease, water must be used, which is not good, especially in cold weather, and water in the stock means heavy expense for coal to dry it out.

On the two main bearings the "oil well" was used; the well being placed in the grease cavity and feeding a felt distributing pad resting on the shaft. The oil fed by means of a few yarn threads, by capillary action, over the edge of the well, one side of which was made low for this purpose. The feed is regulated by the number of threads of yarn leading out of the oil well. These bearings gave no trouble last season, and used about a pint of oil per week, for the two bearings.

On the pitman eccentric bearing the packed box was used (similar to a freight car axle). In this particular instance we found it necessary to feed a little extra oil to the top of the bearing, the reason for which was probably due to the oil grooving not being arranged for this method of lubrication. "Gargoyle fusoline oil heavy" was used on this equipment with best results.

Elevator

The bearings on the bucket elevator are located at a much out-of-the-way place and are hard to get to. On the top of the elevator, all bearings are fitted with bottle oilers. One oiler for each bearing is generally sufficient. These oilers require attention about once a month, although inspected much oftener, and they are automatic in their action, feeding oil only as the shafting turns.

At the foot of the elevator the requirements are not so great, yet these bearings should receive some lubrication. Here the wick-feed cup is used, arranged for a sparing feed. A little oil is put in the cup once or twice a week.

These cups are made of pressed steel and are very rugged. In installing this type of oiler all fittings must be screwed together very tightly, so they will not be knocked to the side by rough usage. "Gargoyle fusoline oil heavy" was used on this equipment.

Dryer

In lubricating the different types of bearings that may be found about the dryer, the methods used may vary in different plants. In the plant in question the bottle oiler was used on all bearings, both on the main girth gear pinion and back gearing to driving pulley, and also on the girth tire roller trunions. Two bottle oilers were used on each bearing. "Gargoyle fusoline oil heavy" gave excellent results on this unit. The dryer in this plant is about 6 ft. in diameter and 60 ft. long.

On some types of bearings used on this apparatus, probably the oil well could be used to advantage.

The first speed reduction from the driving shaft to the back gear shaft is made with the silent chain belt. It is necessary to house the chain very carefully. At some low point in this housing can be provided an oil reservoir, into which the chain will dip very lightly, or a brush by capillary feed of some kind or other. In this plant the chain is permitted to dip in the oil. The Vacuum Oil Co.'s "dark lubricating oil H" was used with success on these chains.

Dry Pan

The dry pan has three distinct types of bearings, each with its own problem. The horizontal driving shaft is easily handled with the bottle oiler, and as a matter of safety two oilers are used on each bearing, although one will prove satisfactory, if the bearings are in reasonably good shape. The vertical shaft is usually provided with large screw compression grease cups. If carefully cared for and screwed down often, these will prove satisfactory, but they are not usually so attended to. The bearing becomes worn and sand gets into the grease hole leading to the shaft, and if any grease gets into the bearing it is laden with grit and is a good cutting medium. Here the individual wick-feed cup automatically keeps a little oil always on the shaft. "Gargoyle fusoline oil heavy" was used on the upper part of this machine.

The step bearing is often located at the lower end of the vertical shaft, and in this location has much to contend with, and it is an extremely hard place to get to. It is hard to keep this bearing lubricated, and usually the wear is great and much oil is used. An oil reservoir was provided holding about two gallons of oil, and a sight feed glass and pin valve has been provided so that a small feed of oil could be seen and maintained. The Vacuum Oil Co.'s "dark lubricating oil H" gave the best results here.

The remote oil well would be a more uniform means of lubricating this bearing, with a valve in the feed line to close off the flow when not operating.

Hydrating and Storage Plant

This part of the plant consists of sand screens, bucket elevators and worm screw conveyors and the large storage bins where the prepared sand is stored until used, and is a cloud of dust and grit. The machinery is driven by sprocket chain belts and all bearings are equipped with bottle oilers which have replaced the screw top compression grease cups. "Gargoyle fusoline oil heavy" was used exclusively on this part of the plant. The lime is ground fine in the lime mill, and after hydrating, it is mixed with the sand in the proper proportion. The final mixing and blending of the sand and lime is done in a tube mill.

Tube Mill

One of the problems that required special attention was the trunion bearing on the tube mill rollers. Grease is universally used as a lubricant on these bearings. The grease openings are large and will receive the sand and grit as well as grease, and it is necessary to re-babbitt often. Our method employed in this plant on these bearings was to fill the grease opening with a felt sack fitted to the opening with flaps long enough to fold over. The sack was filled with wool waste and saturated with a heavy-bodied oil. The external flaps are folded over the top to keep out the sand. Oil is supplied from time to time as required by folding back the flaps and saturating the waste. The bearing cover is kept closed. The Vacuum Oil Co.'s "dark lubricating oil H" was used on this equipment.

Brick Presses

Three of the four brick presses in this plant are what is known as the Boyd press (Chisholm, Boyd & White Co.). As on all such machines there are a number of heavy bearings, rollers and slides to be lubricated. These bearings must be kept tight and not allowed to wear if we make accurate bricks. These machines were originally provided with two and four ounce blind feed glass oil cups. These were fairly satisfactory if given considerable attention and frequent filling, usually two to four times per day. On all the driving shafting, back gearing, main bearings and pitman bearings on the back side of the press we were able to use the bottle oiler, employing "Gargoyle fusoline oil heavy"; one or two oilers to the bearing. These have proven very successful, requiring refilling every three or four weeks. On the front of these machines it was necessary to use the wick-feed oil cup, employing the same oil, as there is no place that we could get a direct shaft action in order to give motion to the feed rod. One and a half and three ounce cups were employed as needed, and a little oil in each cup in the morning lasts all day, feeding uniformly and sparingly and yet sufficiently.

Market Prices in New York

BROOKLYN is taking the lead in building work in the Greater City, and large quantities of materials are moving to this section. The majority of operations embrace those of residential character, but large apartment houses, as now being erected and projected, are good consumers of cement, sand, lime and kindred products. Industrial construction is very slow in this district at the present time.

The local cement market is without interest; the call for material is steady, but orders are considerably below normal. Prices hold well at recently established levels and no early change is looked for. Dealers are asking $3.20 a barrel, delivered on the job, with bag rebate of 10 cents. In the wholesale market, cement is quoted at $2.40 a barrel in carload lots, alongside dock, without bags. The material, delivered to contractors, is around $2.80, without bags.

The lime situation has shown marked betterment during the past fortnight. There is a much firmer call for the material, and current inquiries, if taken as an index, indicate much larger consumption in the near future. Common lime in 300-lb. barrels is being sold by local supply dealers at $4.50 delivered; finishing lime, same size barrel, is priced at $4.70. Hydrate common lime in cloth bags has recently declined $1.50 a ton, making a new price level of $22.50 a ton; hydrate finishing lime, in cloth bags, has also receded $1 a ton, with present quotation standing at $28. The current rebate for lime bags is 20 cents.

Cement plaster, neat, in cloth bags, is selling for $23 a ton, delivered, while finishing plaster is quoted at $28, with bag rebate of 15 cents. Barreled finishing wall plaster is priced at $2.50, for a 250-lb. barrel, and $5.85 for barrel of 320 pounds weight.

Sand, gravel and crushed stone are holding well at present levels. Sand, delivered on the job in the different boroughs, is $1.80 per cu. yd., with some dealers asking more. Fine white sand is $5 per cu. yd., a figure that has been prevailing for some time past. In the wholesale market, sand is $1.25 a cu. yd. in cargo lots.

Gravel, wholesale, is being sold at New York at $2.50 a cu. yd., both 1½-in. and ¾-in. sizes. Dealers are asking $4.25 for the material, delivered. Crushed stone is selling wholesale at $1.90 for 1½-in., and $2.15 for ¾-in. material, f. o. b., city.

Building stone has sagged materially in price during recent weeks, and present figures are about 25 per cent lower than those prevailing previously. The market outlook in this line is growing much brighter, and larger building work as now coming along, bids fair to absorb good quantities of the material. Indiana limestone is selling for $1.78 a cu. ft., while Kentucky selections are priced around $2.25. Sandstone varies from $1.75 to $2.10 in the local market, while bluestone is around the $2 mark. Marble is being sold from $2.25 to $3 a cu. ft., the latter being for sawed white Vermont material.

New York figures can be taken as the near-prevailing prices in the different important New Jersey cities, with a shade or two higher quotations in the South Jersey districts.

Mineral Aggregate Producers Tell Railway Executives Facts

Alex W. Dann, of the National Association of Sand and Gravel Producers Proves More Than a Match for Triumvirate of Railway Vice-Presidents

THE MANY-TIMES POSTPONED "HEARING" of the producers of roadbuilding materials, graciously granted (after much pressure) by the railway vice-presidents, who as committee-chairmen are in charge of traffic of eastern, southern and central freight associations, took place in Washington, D. C., June 2.

The railways were represented by G. H. Ingalls, vice-president of the New York Central Lines; Lincoln Green, vice-president of the Southern Ry.; Edward Chambers, vice-president of the Atchison, Topeka & Santa Fe Ry., and many lesser traffic officials representing other railways in the three freight association territories.

The producers were represented by A. N. Johnston, president of the National Association of Sand and Gravel Producers; E. J. Krause, president of the National Crushed Stone Association; E. Guy Sutton and A. P. Sandles, secretaries of the two associations, respectively, and by special committees of each association besides many other prominent producers. In addition to these the National Paving Brick Manufacturers Association was represented by its secretary and several prominent producers, the Asphalt Association, and the Tar Products' Association by their secretaries.

Eugene Morris, chairman of the Central Freight Traffic Committee at Chicago, acted as chairman for the railways, and E. Guy Sutton, secretary of the National Association of Sand and Gravel Producers, was chairman for the producers. In opening the meeting, Mr. Morris said that the conference had been arranged for originally by Mr. Sutton and that the other interests had subsequently been allowed to come in.

Alex W. Dann, Spokesman

Alex W. Dann, general manager of the Keystone Sand and Supply Co., Pittsburgh, Pa., as chairman of the Sand and Gravel Association's freight-rate committee, presented the case for the industry. Mr. Dann had devoted himself religiously to the preparation of this case and his faithful straightforward presentation of the unanswerable facts left a splendid impression with every listener. A brief of his argument is appended hereto.

After he had given nearly two hours to a recital of these facts the spontaneous applause from railway men as well as producers was ample evidence of their appreciation of the thoroughness with which he had covered the subject. Whether or not the industry attains its object, it owes Mr. Dann a lasting debt of gratitude for his time and effort, and the able manner in which they were directed.

Alex W. Dann, Chairman, Freight Rate Committee, National Sand and Gravel Producers Association

The principal other "witnesses" for the producers were John Rice, president of the General Crushed Stone Co., Easton, Pa., and former president of the National Crushed Stone Association; W. R. Sandborn, of the Illinois Crushed Stone Association, and A. P. Sandles, of the National Crushed Stone Association. Mr. Rice gave succinctly and clearly the experience of his own company, which operates a number of plants in the Northeastern States. He showed the effect of curtailed production on the cost of production and its effect on the price of ballast of which the railways would soon be large purchasers. He cordially seconded the testimony of Mr. Dann and gave added data to show that the present railway freight rates were de-centralizing or localizing the stone industry.

L. T. Sunderland, president of the Ash Grove Lime and Portland Cement Co., gave some very pertinent facts in regard to the effect of present high freight rates on the costs of cement manufacture, where stone or other raw material has to be brought from any distance by rail. He also gave the lime and cement manufacturers' endorsement of lower freight rates on sand, gravel and stone, as necessary to rehabilitation of the construction industry as a whole.

Public Officials Help

S. E. Bradt, state highway commissioner of Illinois, made the opening address on behalf of the producers. He showed how increased freight rates had increased the cost of roadbuilding in this state and were the primary cause of holding up nearly all state work. George M. Barnard, a member of the Indiana Public Service Commission, also said several good words on behalf of the producers.

Railway Officials Ask Questions

After the producers' representatives had recited their story the railway officials asked a few questions. Some railway men were inclined to be a trifle facetious, but Mr. Dann succeeded admirably in making them appreciate the seriousness of the situation from the producers' point of view. Most of the questions were evidently intended to establish that any possible freight rate reduction would have little effect on the ultimate cost of a mile of road. However, it was quickly and conclusively proved to them that the recent increases in rates had added at least 20 per cent, on an average, to the complete cost of a mile of concrete road.

Other points brought out by the railway men showed plainly that they considered paved roads and heavy motor trucks as competitors to be seriously reckoned with, so long as the roads were constructed and maintained wholly at the taxpayers' expense. As large taxpayers themselves they evidently object to the free use of the highways by rival transportation companies using motor trucks. It was evident that some of them were not very keen to encourage roadbuilding until motor truck freighters are made to pay for the use of public highways.

Promise Early Action

The session ended with the railway men promising to take the matter under advisement and to announce soon what

they would do. Mr. Green, of the Southern Ry., in making the closing statement gave the impression that he considered freight rates on these materials largely local issues, to be acted upon separately by the local traffic committees or possibly by the individual roads.

Present at Hearing

V. O. Johnston, E. Guy Sutton, Alex. W. Dann, V. P. Ahearn, National Association of Sand and Gravel Producers.
Chas. Donley, Ohio Valley Sand & Gravel Ass'n.
E. Brooker, Pennsylvania Sand & Gravel Producers Ass'n.
T. R. Barrows, National Sand & Gravel Bulletin.
Geo. J. Bolender, Michigan Sand & Gravel Producers Ass'n.
A. P. Sandles, National Crushed Stone Ass'n.
Francis B. James, National Paving Brick Mfrs. Ass'n.
Maurice B. Greenough, National Paving Brick Mfrs. Ass'n.
S. E. Bradt, American Ass'n of State Highway Officials.
Chas. H. Moore, Pennsylvania State Highway Dept.
H. E. Hilts, Pennsylvania State Highway Dept.
Geo. M. Barnard, Indiana Public Service Commission.
Lawrence E. Lyons, Indiana State Highway Commission.
W. Scott Eames, New Haven Trap Rock Co.
Michael Doyle, International Pulp Co.
J. E. Carroll, J. E. Carroll Sand Co., Buffalo Gravel Co.
W. L. Sporborg, Rock Cut Stone Co.
F. W. Schmidt, North Jersey Quarries.
J. A. Middleton, Eagle Picher Lead Co.
Hugh L. Haddon, Menantico Sand & Gravel Co.
John M. Braly, Bennett Gravel Co.
John Rice, General Crushed Stone Co.
G. L. Wade, Builders Exchange of Baltimore.
Chas. L. Ruffin, Massaponax Sand & Gravel Co.
Davis Alexander, Petersburg Sand & Gravel Corp.
W. W. Baxley, L. J. Baxley, W. W. Baxley & Co.
Allen Patterson, Bluffton-Lewisburg Stone Co.
Guy C. Baker, Greenville Gravel Co.
Geo. J. Nattkemper, Summit Sand & Gravel Co.
W. R. Sanborn, Lehigh Stone Co.
F. C. Murphy, Brownell Improvement Co.
Thomas McCroskey, American Limestone Co.
E. J. Krause, Columbia Quarry Co.
L. T. Sunderland, Ash Grove Lime & Portland Cement Co., Iola Cement Mills Traffic Ass'n.
S. A. Fones, Independent Gravel Co.
John Prince, Stewart Sand Co., Prince-Johnson Limestone Co.
H. F. Curtis, Lyman Rickey Sand Co.
H. E. Stringer, Ralph Simpkins, Hydraulic Press Brick Co.
H. M. Keaskey, National Fire Proofing Co.
R. T. Hutchins, Mack Manufacturing Co.
D. R. Potter, Thornton Fire Brick Co.
P. B. Belden, The Belden Brick Co.
Spencer M. Duty, Medal Paving Brick Co.
J. L. Murphy, Ohio Paving Brick Mfg. Ass'n, Hocking Valley Brick Co.
O. W. Rennert, J. G. Barbour, Metropolitan Paving Brick Co.
F. L. Manning, Peebles Paving Brick Co.
Walter McKeen, The Burton-Townsend Co.
Frank R. Hale, Vigo American Clay Co.
C. C. Barr, The Barr Clay Co.
W. M. Lasley, Southern Clay Manufacturing Co.
Chas. A. Freiberg, Buffalo Cement Company, Ltd.
Geo. J. Frye, Duquesne Slag Products Co.
F. T. Bentley, Universal Portland Cement Co.
J. E. Pennybacker, The Asphalt Ass'n.
J. L. Roberts, Philip P. Sharples, The Barrett Co.
J. P. Brown, The Barben Asphalt Paving Co.
E. A. Fall, U. S. Asphalt Refining Co.
E. D. Sheffe, Herbert Spencer, Standard Oil Company (N. J.)
Leroy M. Law, New Orleans Refining Co., Inc.
R. C. Wright, Pennsylvania System.
Archibald Fries, Baltimore & Ohio Railroad.
C. A. Blood, Lehigh Valley Railroad.
P. J. Flynn, D., L. & W. R. R.
T. C. Powell, Erie Railroad.
R. L. Russell, Philadelphia & Reading Railway.
A. Hamilton, Central R. R. of New Jersey.
J. B. Stewart, N. Y., O. & W. Railway.
J. W. Allison, Western Maryland Railway.
E. A. Niel, Buff., Roch. & Pittsburgh Ry.
W. G. Story, Delaware & Hudson Company.
J. W. Rimmer, Boston & Maine Railroad.
E. D. Hotchkiss, Chesapeake & Ohio Railway.
R. L. Burnap, Grand Trunk Railway System.
F. Zimmerman, C., I. & L. Ry.
C. H. Stinson, Wabash Railway.
C. M. Booth, Pere Marquette Railway.
G. H. Ingalls, J. Gottschalk, Traffic Executive Committee, Eastern Territory.
E. H. Shaw, Southern Railway System.
C. R. Capps, Seaboard Air Line Railway.
R. A. Brand, Atlantic Coast Line R. R.
C. T. Airey, Central of Georgia Railway.
A. R. Smith, Louisville & Nashville R. R.
D. W. Longstreet, Illinois Central Railroad.
Chas. Barham, N., C. & St. L. Railway.
Lincoln Green, Southern Freight Rate Ass'n.
Edw. Chambers, W. G. Barnwell, A., T. & S. F. Ry.
H. W. Beyers, C. & N. W. Ry.
G. W. Luce, Southern Pacific Company.
H. H. Holcomb, C., B. & Q. R. R.
H. M. Adams, Union Pacific System.
L. J. Spence, Western Traffic Executive Committee
R. N. Collyer, Trunk Line Ass'n.
Eugene Morris, Central Freight Ass'n.
N. W. Hawkes, New England Freight Ass'n.

Statement of Alex W. Dann to the Railway Executives

Railways Must Reduce Freight Rates or the Mineral Aggregate Industry Will Reorganize to Do Business Without Them

WE REPRESENT the National Association of Sand and Gravel Producers, in which organization about four hundred companies have associated themselves. Through a large expression of interest and concern on the part of others, not members, we represent the entire industry of the United States. By request we represent also the shippers of chat. There are about twelve hundred plants in the United States, with potential capacity of about three hundred million tons per annum. We do not know the amount of revenue freight we furnish railroads, but with allied materials we stand second alone to coal. There are many plants with investment of one-half million dollars and a considerable number with investment exceeding one million dollars. We do not know the total invested capital of the industry, but would hazard an estimate of $100,000,000. This industry has developed within the present century from a small one to one of large importance, and with the development in size has come development in quality and more diversified sizes in the product.

Our Difficulties

We come to present our difficulties, which are also your own. We realize you have your troubles concerning operating ratio and that you are entitled to a fair rate and revenue. We admit that the freight rate is not the only thing retarding industry in general, your business and our business, at the present time; but we emphatically assert that it is a tremendously large element of the present depression.

To develop facts, we sent questionnaires to our membership, to the highway departments of each state, to the counties in the state of Indiana, and we developed facts from the data at the U. S. Geological Survey and the Bureau of Public Roads. We review results below:

First

Our membership reports from Florida that present rates have absolutely demoralized the sand and gravel business and we will be forced to discontinue operations soon if we do not get some relief. Our old customers are using inferior rock and red clay as a substitute to get away from excessive freight rates.

From Georgia we are told the increases in freight rates have entirely eliminated our business in southwest Georgia. We have lost contracts at various places which we specify. Consumers are unanimous in opinion that present freight rates are prohibiting return of business to normal lines of movement. Decrease in rates will increase our shipments by rail.

The state of Illinois made a contract for improvement of highway in Kane County, an average railroad haul from our plant of 12 miles, with loaded movement in direction of coal mines. The freight rate is 80 cents per ton, which, under our average loading of 54 tons, gives the railroad $43.20 per car for this transportation. As a result, contractor secured gravel land on right of way, installing plant to cost him $20,000, producing 1,200 cars of material necessary to supply job. Loss of revenue to the railroad, $43,000.

Indiana formerly had contract shipment 100 cars to Youngs, Ind. Contractor claimed under increased rates he would lose money; so we released him to buy a local pit seven miles distant from job, from which he is now trucking materials. Trucks have replaced rail shipments to the following points, five in number, which are listed. Practically all towns within radius of 10 miles hauling by truck so that our car business has been reduced one-half.

We lost business in 20 towns in Iowa where customers hauled inferior material from local pits rather than pay freight rates. The trade is now 90 per cent by truck and the railroads are losing the business. Our average haul from January 1st to September 1st, 1920, was 60 miles. Average haul on first 216 cars shipped in 1921, 43 miles, illustrating that freight rate has reduced our territory.

From Minnesota we learn that many roadside pits are developing wherever there is any business and material is being hauled by truck. A number of our

customers are using inferior material from local pits.

In Ohio we find for seven years prior to June, 1918, we shipped 1,000 cars per year to Portsmouth, a distance of 20 miles. Since June, 1918, we have shipped a total of 18 cars. We had contract for 1,000 cars in Columbus, Ohio, on April 1, 1920, but due to 40-per cent increase, we delivered 200 cars only.

In Pennsylvania, we had contract for 210 cars. Contract canceled and delivery made by truck due to high freight rates. One customer formerly bought 425 carloads per year by rail. He now gets delivery by combination of river and truck haul. First three months 1920 trucks and river delivered 0.4 of 1 per cent our production. First quarter 1921 they delivered 66 per cent.

From Virginia: January, 1919, to August, 1920, average shipments 377 cars per month. After increase August, 1920, to April, 1921, total shipments only 234 cars.

From West Virginia: Road Department and bridge company which are named receiving shipments by truck and river instead of by rail.

From Nebraska: 1,000 carloads material furnished by truck on paving jobs which would have gone by railroad if there had been a reasonable rate.

Second

State Highway Departments answer the question as to effect of increase in freight rates on road building program from Alabama materially lessened our program for 1920 and forced us to use inferior local materials from which railroads got no business.

Arkansas: Has tended to stop work and prevent completion of some old projects.

Georgia: Reduced number of miles built and changed type of road to use local materials.

Indiana: Has stopped all new construction work.

Kansas: Increase in rates has retarded road program 50 per cent.

Mississippi: Roads that could have been built before increase now impossible to finance.

New Hampshire: Caused us to use poor local material.

Wisconsin: Tended to decrease the amount of work.

In answer to our question of estimate as to average increase in cost per mile of road due to freight increase of August, 1920, we find the answers range all the way from $575 per mile to 20 per cent of total cost. Departments expressed almost unanimous opinion that freight rates on sand and gravel are too high. One says that good roads increase the railroad business; another that we are prepared to let on short notice new contracts requiring one and a quarter million tons of concrete aggregate if delivered prices of material become satisfactory. Another that any rate is too high which results in traffic not standing it. And another, too high in comparison with other rates.

And South Dakota says: Yes, an estimate received on hauling sand and gravel 48 miles by railroad was $2.70 per yard or $5,400 per mile. No comment is necessary except that this is to be a heavy-traveled road and for a long time will be but an earth road.

Third

The Highway replies develop that about 6,000 miles of road are contemplated for 1921 which will require about 18,000,000 tons of aggregate. The U. S. Geological Survey reports for 1920 54 million tons sand and gravel produced in the country, of which total, one-third would be required to build the above concrete roads alone, without allowance for other types of roads and general concrete construction. The 1920 Geological figures show decrease of 14 per cent from 1914, while figures from Department of Public Roads show increase in concrete road construction for same period, 541 per cent. In other words, to build the concrete roads alone in the United States in 1920 would more than absorb all sand and gravel reported to Geological Survey indicating that material must come in large quantities from local and temporary operations from which railroads derive no revenue. It is interesting to observe the sharp decrease in Geological Survey figures for 1918 over 1917, namely 36 per cent, and remember in this connection that General Order No. 28 came out in June, 1918.

Fourth

Summary of questionnaire to 92 counties in Indiana developed that increase in freight rates stopped railroad transportation of 1,800,000 tons of sand and gravel. Some 80 per cent of counties reporting state that same cause has caused development of use of local material and many state that the local materials are of inferior quality. One county, called Greene, states briefly: "Decrease tonnage due to high freight rates, 100 per cent. Charge $10 a ton, if you like. We should worry. We have installed four local stone crushing plants."

The Highway Commission, State of Indiana, further advises that loss to railroads of tonnage on account of high freight rates for repair work only has amounted to 437,000 tons per annum. They further state that half of material is usually shipped by rail, but that at present, owing to high freight rates, they believe that 25 per cent of the material only is being shipped by railroads. They state that a reduction in freight rates on road materials is necessary immediately to head off the rapid change from rail transportation to truck haul from locally developed plants.

The above questionnaires do not represent in their answers 100 per cent of those asked for information, due to shortness of time available, but are representative and in large volume, the results of which are presented in concrete form for your perusal.

Results Shown

First

The public suffers due to use of inferior materials instead of securing those from established plants producing high grade of material. The public must pay for the roads which are damaged due to marvelous increase in truck transportation.

Second

Yourselves and ourselves suffer jointly in that you are losing immense tonnage due to rapid development of truck, wagon and water delivery wherever these are at all possible. We suffer because the business is being diverted from established plants along your lines and going in large measure to local production.

Transportation Characteristics of Sand and Gravel

As a rule, consumer pays the freight, our prices being f. o. b. cars at plant, so that direct transportation cost is not our own, but when the consumer cannot afford to pay the freight, our business suffers because our territory is restricted.

Sand and gravel are a low-grade commodity, the lowest grade which you haul. The U. S. Geological Survey of 1919 gives average sale price of sand as 56 cents, and gravel as 66 cents. **From our questionnaire, we develop that our representative territories of the United States our present f. o. b. price of material at the plant is equaled by the freight rate when you have hauled the material an average of 12 miles.**

We stated that railroads should have a fair rate, but we emphatically say that our commodities are bearing more than just share of transportation burden. Considering their heavy loading, indestructibility, very low value, volume from each shipping point and utter absence of risk, no commodity should pay less per car mile and per ton than these. Judged from the standpoint of value to shipper, cost of service on the ad valorem theory or any other theory, all that the traffic will bear or all that it should bear, sand and gravel are at the bottom of the list.

What We Do Pay

First

We pay more than the average revenue derived for the transportation of all freight.

We have our Statement No. 5 showing actual movement in eastern district of 1,424 cars moved an average of 36 miles, on which our average rate was 78 cents, our average loading 54 tons per car, your average revenue per car mile $1.16. No

summary was available showing general average for all of these roads on all commodities, but we call your attention to the fact that the B. & O. R. R. hauled general commodities 194 miles for an average revenue per car mile of 25 cents, and that the C. C. C. & St. L. R. R. hauled them for a general average of 22 cents.

In the western territory on movement of 610 cars on 14 railroads, we find the average distance 64 miles with an average rate of 97 cents and a car mile earning to you of 74 cents as compared with average on all freight running about 25 cents per car mile.

The comparison in the eastern district is from 1919 before the last increase. In the western district the actual shipments were made after the increase and we have taken reasonable adjustment of 1919 all freight revenues for comparison. Figures for the southern district were not available in time for this review.

Second

Sand and gravel pay more than other commodities of higher value and less favorable transportation characteristics.

We submit to you our Statement No. 6, which is a comparison of rates and revenues on sand and gravel with bituminous coal in effect prior to August 26, 1920. This and following statements are long, but a typical example shows that sand and gravel hauled from Pittsburgh to Youngstown, a distance of 65 miles, paid $1.10 per ton as against hauling of bituminous coal to Youngstown from groups 4 and 6, 108 miles, with a rate of $1.05. It shows a revenue per car of coal of $52.50 and of sand and gravel of $55, and revenue per car mile on coal 48.6 cents as against 84.6 cents on sand and gravel, basing car loading of each at 50 tons, which favors the coal.

Our Statement No. 7 shows that to haul coal from Brownsville to McKeesport costs $1.26 per ton. If we load the car with sand and gravel and send it back to Brownsville, a distance of 43 miles, we pay $1.50 per ton. Other and numerous examples are cited to show this unreasonable condition.

Our Statement No. 8 compares rates and revenues on sand and gravel with various other commodities which shows that in the case of rate to Youngstown from Pittsburgh, Pa., hay, sewer pipe and pig iron pay somewhat more per net ton for their transportation. On account of the heavy loading of sand and gravel, it pays more per car mile than any of the rest with the exception of being slightly less than pig iron. The average revenue per car mile on sand and gravel figured $1.10; hay, 66 cents; sewer pipe, 53 cents; and pig iron, $1.04. This is on basis of rates prior to August 26, 1920, and the relation does not seem proper in view of the fact that sand and gravel then sold for very much less per ton than the other commodities mentioned which range in value from five times as much to 60 times as much as sand and gravel prices. The matter of risk in transportation must not be lost sight of.

Our Statements Nos. 9, 10, 11 and 12 show further comparisons of rates and revenues derived by the railroad from transportation of our commodities and other commodities. We find that in most instances sand and gravel pay more per ton freight for the same distances hauled than pig iron, billets, ore except iron ore, mill cinder, ice, dolomite, building stone, iron and steel articles, acid in drums, ingot moulds, powdered charcoal and chloride of calcium. We cannot review them at length at this time.

These statements show conditions in the eastern territory, especially, because that data is available at this time for presentation, but they likewise reflect general conditions throughout the whole country concerning which we have considerable additional data not summarized, because of lack of time.

Our Statement No. 13 reflects predominant rates in effect on various roads for various mileages which is an interesting study.

Effect on Our Rates of General Order No. 28 and Ex Parte No. 74

We do not come here to attack the motives of anyone in putting in effect Order No. 28. It was necessary in war times to get more revenue quickly and the problem had to be dealt with largely and in a general way. But we do contend that with our commodities of favorable characteristics, we were discriminated against in that instead of receiving an increase of 25 per cent, we received a flat increase of 20 cents a ton, which roughly, developed an increase of 55 per cent.

Our Statement No. 14 shows the effect of General Order No. 28 in the eastern district and also develops the effect of increases from April, 1918, to the present time. It shows you that No. 28 gave us an increase of 17 per cent to 50 per cent in that territory on representative rates. The smaller percentages were for the longer hauls upon which the bulk of the traffic does not ordinarily move. Taking again the western district, we find that the average increase due to General Order No. 28 on shipments from one to 300 miles gave an average increase of 37 per cent instead of the 25 per cent called for by the order.

Our Statements No. 16 and No. 17 show the effects of Order No. 28 as well as other increases on specific shipments or rates, and it develops that General Order No. 28 increased the freight rates from 14 per cent to 50 per cent.

Neither do we question motives or expediency in the case of Ex Parte No. 74, since it was made clear perhaps that the railroads must have more revenue. We do not admit that so far as our industry was concerned, the proper steps were taken to get more revenue. This increase pyramided the results of the increase of 5 per cent, 15 per cent and 55 per cent, it seeming that the freight rates came down upon us very much as the rain upon the just and the unjust, without discrimination between those who could or should bear the advances, and those who could not and should not bear them.

Statements No. 14 and Nos. 15, 16 and 17, previously referred to, show the total percentage advances of the past including the last order. In the western district we see that Order No. 28 and Ex Parte No. 74 gave an average increase of 86 per cent. In the western district we find that exclusive of the 15-per cent advance, the total increase in the last three years has varied from 95 per cent to 211 per cent on various rates applying. We find that increases from October 25, 1914, to August 26, 1920, have been in some cases as high as 320 per cent and many for the particular territory covered have been 200 per cent.

Our Statement No. 19 is interesting in that it shows percentage of increase in revenue on all freight from 1917 to 1919 as compared with the same percentages on sand and gravel. We find that the revenue per car on all freight on a representative railroad increased 25½ per cent, while the average revenue on sand and gravel increased 87½ per cent.

Our Statement No. 18 shows on another road an increase of revenue of 40 per cent on all freight and 67 per cent on sand and gravel.

Conclusion

Gentlemen, we feel that we are engaged in a fight for the very life of our industry as now constituted. From every hand we hear that relief must come and come quickly if the established industry for the production of superior materials is not to be de-centralized. At the time of the promulgation of Ex Parte No. 74, the Commission took cognizance of the fact that our commodities might be bearing more than our share of the transportation costs and recommended to the railroads and shippers that they should confer and adjust any inequalities and injustices without recourse to the Commissions. We have not been able, although we have tried, to secure this relief by negotiations heretofore carried on with the railroads. That is really why we are here and that is why we have been compelled in many localities to file complaints before the Commissions involving ourselves and the railroads in large expense and annoyance looking toward the solution of this very **pressing problem.**

If we have interested you at all, you are probably ready to ask us what is the solution of this situation and what you can do for us. We can answer that in 1920 it was declared that an emergency existed and that there must be more revenue derived by the railroads and that at once, there being no time to determine the proper additional charges for the several commodities. So at that time were applied the increases of 25 per cent, 35 per cent and 40 per cent. We declare that an emergency exists now and ask you if you want to have the business of hauling one hundred million or more tons of mineral aggregate, or do you wish to have this business slip away to your competitors, the trucks and the water transportation, because you do not see fit to reduce your asking price, which is the freight rate. You are losing a very great revenue and you need it. You are losing a revenue which you can secure by meeting at a profit your competition.

We are confronted with an emergency which should also concern you. Our established business is being decentralized. If present rates are maintained, we must of course establish more plants which are unnecessary and ourselves deliver the material by trucks and water. Remember, too, that the public has an interest in this thing in that it desires more construction work and it desires that the materials entering into that construction shall be superior. We want to add also that the effect of starting the construction industry will tremendously stimulate industry in general.

Now, we ask you in all seriousness to remember the old saying, "He who helps quickly, helps twice." If a decrease in transportation charges is to help our industry and your industry and the construction industry this year, or even next spring, the action must be taken now. We ask you to at once put in effect rates not more than those in effect before the application of Ex Parte No. 74, and then clothe with full authority accessible representatives of your roads with whom can be promptly taken up situations which are obviously unfair and unreasonable, so that we will not be compelled to go further before the bodies constituted by law to care for the interests of the carriers and the shippers and the public alike. We will ask you, gentlemen, if it be at all possible, that your decision in this matter be made known to us within a week.

Time for Filing Claims

THE SENATE Interstate Commerce Committee adopted, May 26, a favorable report on the bill amending section 206, paragraph C, of the transportation act, so as to extend the time for the filing of overcharge claims to two years beyond end of Federal control instead of one year.—*The Traffic World.*

Decision of Traffic Executives on Freight Conference

UNDER date of June 7, Eugene Morris, chairman of the National Freight Rate Conference held in Washington, D. C., June 2 and 3, in transmitting official copies of the proceedings enclosed a memorandum setting forth the conclusions of the carriers. The memorandum, which is appended, has also been made the subject of Circular No. 7 issued by the National Sand and Gravel Producers:

"At a series of conferences held in Washington on June 2nd and 3rd, between the traffic executives of important rail carriers of the United States and representatives of associations and shippers interested in the movement of sand, gravel crushed stone, chert, slag, asphalt, tar, paving brick, cement, yellow pine lumber, short leaf pine lumber, redwood, fir, hemlock, oak, gum, cottonwood and other hardwood lumber, logs, building brick, tile, terra cotta, talc, and other building materials, the carriers were urged by representatives of the building tile and building brick interests to reduce the rates on these commodities by eliminating the advance of 40c per ton established under General Order 28 and applying the percentage under Ex Parte 74 to the rates in force prior to General Order 28. Representatives of other shipping interests asked for a reduction equaling the entire advance authorized by the Commission in Ex Parte 74.

"The tonnage directly affected by these requests approximates 25 per cent of the total tonnage of the railways of the United States, and the carriers are asked to yield on this traffic approximately all of the increase authorized by the Interstate Commerce Commission in Ex Parte 74.

"It cannot be overlooked that there are many articles analogous to those above mentioned, on which the demand and the equity of reduced rates could be equally as pressing and as great as they are with respect to the commodities mentioned, and it would be difficult, if not impossible, to prevent the inclusion of these analogous articles in any reduction in rates such as is now requested. Thus substantially more than the 25 per cent of the total tonnage of the railroads above mentioned would be either directly or indirectly involved in the requested reductions. The seriousness to the carriers of this proposal is thus evident.

"The conferences developed that, while in the opinion of various shippers reductions in freight rates would stimulate the movement of these commodities, the fact remained that this was altogether conjecture, and that there was no assurance that any reduction in freight rates would substantially increase the movement of this traffic. It was admitted that reductions in the selling prices of some of the commodities mentioned, far exceeding the present total freight rates, had failed to create any broader markets.

"It was also clearly brought out that the hope of reductions in freight rates has resulted in hesitancy on the part of consumers and dealers to place orders, and because of this it was urged that the carriers promptly announce their conclusion in order that the present uncertainty may be cleared up.

"After a most careful consideration of the situation as presented by the shippers, and of the present and prospective financial conditions of the carriers, the representatives of the carriers concluded that under existing conditions no general reduction in freight rates can be justified or made effective, and that the carriers are in no condition to accept the far-reaching consequences of the reductions requested at these conferences.

"The carriers, no less than the shippers, are anxious to work towards a lower level of rates, but it is manifest that this result cannot be accomplished until there is such a reduction in operating costs and increase of business as will restore the proper relation of net to gross earnings.

"In notifying the shippers of this action, the carriers stated:

"No industry in the country is in more acute distress than are the railroads. Many are not earning their operating expenses and taxes, many more are not earning interest charges, and no group of railroads is earning anything approximating the return contemplated by the Transportation Act to enable them to provide the facilities necessary to accommodate the normal commerce of the country.

"Obviously, therefore, the carriers cannot afford to make any general reduction in rates, nor even the reductions that would follow from the acceptance of shippers' proposals.

"The reduction in wages recently authorized by the Labor Board, but not yet realized, is more than offset by the decreased volume of business due to world-wide conditions affecting, generally speaking, all business and all interests. This traffic does not now produce, even under the advanced level of rates, a margin of profit anywhere near sufficient to meet the universally recognized needs of the carriers. It is a fact that the increases allowed by the Interstate Commerce Commission in August, 1920, in response to the provisions of the Transportation Act, are yielding the carriers less by

$662,000,000 per annum than the return contemplated by the Transportation Act, and there has been no estimate from any source that the recent wage reduction will even approximate that figure.

"The carriers are vitally interested in any changes which will produce needed revenue and would be justified in considering reductions could they have any reasonable assurance that the volume of traffic would be augmented sufficiently to increase their net return. However, the arguments presented indicate that even in the minds of the shippers the result of any substantial reduction in rates is purely speculative not only as to increased volume of traffic but also as to the time when an increased volume of traffic may be expected. It should be universally recognized that the carriers are in no condition to enter the field of uncertain experimentation substantially involving their revenues, for the reason that disappointment in the experiment would result in serious consequences to the public as well as to the carriers themselves, by impairing their ability to continue to furnish needed transportation to the commercial public.

"It must not be overlooked that the carriers have realized that the percentage increases in rates produced inequalities and in many instances threw rates out of line, and to correct these conditions they have been and are diligently adjusting such situations.

"There are doubtless instances and local and special conditions in respect to the movement of commodities necessary for road building and also other traffic which should be considered as emergencies, and the carriers wish to emphasize the fact that arrangements have been made to treat such cases as expeditiously as the circumstances will permit, upon application of shippers to the traffic managers of the interested railroads."

Emergency Petition May Be Filed

CIRCULAR No. 7 of the National Association of Sand and Gravel Producers comments on the above memorandum:

"It may be expected that a certain amount of relief will be secured by taking up specific cases with the individual railroads as proposed, especially in so far as inequalities and maladjustment of rates are concerned. However, such a method will not necessarily correct the injustices brought about by the flat advances prescribed by General Order 28 and the percentage increases authorized by Ex Parte 74, nor will it result in reducing rates on sand, gravel, and crushed stone to a warranted lower level. Moreover, the course of procedure suggested by the carriers will be slow of operation and will not effect an immediate settlement of the matter, which is imperative if construction work is to be stimulated this season.

"The Traffic Committee of the National Association is, therefore, giving consideration to the advisability of immediately filing an emergency petition with the Interstate Commerce Commission asking for a reopening of Ex Parte 74 and the cancellation of the advances effected thereby; the decision of the committee in this regard will be announced later."

Sand and Gravel Man Objects

REGARDING the foregoing, the following letter has been received, indicating the point of view of sand and gravel interests toward the answer of the committee of railroad executives:

Bennett Gravel Company
Spring Lake, N. J., June 9, 1921.

To the Editor of "Rock Products," Chicago, Ill.

Dear Sir:

We are in receipt of the answer made by the committee of railroad executives to the request of the producers of road-building materials for the reduction in rates.

We are in no way surprised at the reply so received, and the reason given by the executives for refusing to consider the reductions asked for have the same old dog-eared, time-honored, and familiar sound, to the effect that the railroads are poor and need the money.

It seems quite plain that the executives have not yet discerned the difference in situation between these low-grade commodities and the total mass of freight. This is because they still harp on terminal costs, which they claim to be so heavy, and which their traffic men appear to know so little about. The facts are that these blanketed advances have stopped the movement and consequently the revenue of a large proportion of these low-grade commodities; and whatever the executives say about rate adjustment being satisfactorily considered and corrections continually made, there has been no adjustment and no correction in the rates from the plant of this company, and I think I can point out a great many other plants at which the same condition prevails.

I do not believe the reluctance of railroad traffic men to recognize the situation with regard to sand, gravel and crushed stone comes from any desire on their part to curtail the business; but it seems to me that they have not been furnished by their accounting departments with sufficient information as to the cost to their respective roads for moving these commodities, and until something more is known about costs as compared with the costs of moving the joint bulk of all the freight, the present condition will continue to be what it is; that is to say, many low-grade commodities such as ours continue to bear an unjust proportion of the total freight burden while many other commodities which should pay higher rates escape, as now, without paying their share.

Yours very truly,
JOHN M. BRALY,
Sec'y.

Construction Activity Increases Slowly

CONSTRUCTION activity in May, according to figures published by the F. W. Dodge Co., was 9½ per cent greater than in April. Contracts awarded in the 27 northwestern states of the country during May amounted to $242,093,000, compared with $220,886,000 in April.

The increase in activity should have been greater except for widespread labor troubles. In New England and throughout the Middle West, where wage disputes have been pretty general, building activity kept up during May at about the same rate as in April. Substantial increases in activity were reported in the territory along the Atlantic Coast from New York to South Carolina.

Building activity of the first five months of the year compares very favorably with the same period of previous years. The total investment represented by building contracts let from January 1 to June 1 has amounted to $839,357,000. At the end of January, activity from the first of the year to date was six per cent behind the average for the preceding five years; at the end of February, 11 per cent behind; at the end of March, four per cent behind; at the end of April, five per cent ahead; at the end of May, 11 per cent ahead.

The demand for new construction still continues strong. Contemplated new work was reported in May to the amount of $462,785,000, which is 18 per cent greater than the amount reported in April.

During the first five months of the year more than two billion dollars in contemplated new work has been reported. This is considerably more than double the amount of contracts awarded, and indicates the pressure of the demand for construction. It is to be hoped that the labor disputes now in evidence will be rapidly settled so that the summer months may witness a substantial increase in activity.

Road Gravel Bids in Minnesota

THE CONTRACT for graveling about 14 miles of road in Yellow Medicine County, Minnesota, has been awarded to I. R. Reber of Marshall, Minn., for $20,000. There were 25 contractors bidding for this contract and the bids averaged 50 per cent lower than bids received last year for the same work.

Railways Protest Preferential Rates on Agricultural Lime

Virginia Carriers Give Their Arguments Against New Mileage Schedule

RICHMOND, VA., May 31st, 1921.
File - 2019

Major Alexander Forward, Commissioner, State Corporation Commissioner of Virginia, Richmond Virginia.

My Dear Sir: For the Virginia carriers and for the reasons stated in protest filed with your Honorable Commission on April 29th, Case No. 1159, "Reduction in the rates upon ground limestone and ground marl for acid soil treatment," you are respectfully petitioned to re-open the case of rates upon ground limestone and ground marl, numbered as above, the same to be heard at the time set for hearing in case of William E. Carson and Warner Moore, representing the Agricultural or Burnt Limestone Interests in Virginia, Case No. 1284.

Our specific grounds for petitioning the reopening of this case are clearly outlined in the protest filed on April 29th.

In accordance with your request, we are enclosing twenty (20) copies of this petition, together with the protest above referred to.

Yours very truly,
(Signed) E. D. HOTCHKISS

For Atlantic Coast Line Railroad Co.,
" Baltimore & Ohio Railroad Co.,
" Carolina, Clinchfield & Ohio Railway Co.,
" The Chesapeake & Ohio Railway Co.,
" Louisville & Nashville Railroad Co.,
" New York, Philadelphia & Norfolk Railway Co.,
" Norfolk Southern Railroad Co.,
" Richmond, Fredericksburg & Potomac Railroad Co.,
" Seaboard Air Line Railway Co.,
" Southern Railway Co.,
" Virginian Railway Co.,
" Washington & Old Dominion Railway,
and others.

To the State Corporation Commission of Virginia: In regard to the Order of your Honorable Commission in the matter of Rates upon Ground Limestone and Ground Marl for Acid Soil Treatment. Case No. 1159.

The Virginia Carriers have directed compliance with the Order in this Case, but desire to advise the Commission that they do so *under protest* upon the following grounds:

First—For the reason that the rates are unreasonably low, and do not, under present operating conditions yield remunerative revenue to the carrier for the transportation service.

Second—For the reason that there is no justification in granting to one class of consumers more favorable rates, under similar conditions, than apply to other consumers.

Third—For the reason that the restoration of rates to the level of those in effect prior to the Order of the Federal Commission in Ex Parte 74 places a further burden upon the Railway by reducing its earning power under the Transportation Act of 1920, which must be made up by an increased burden upon other traffic.

Fourth—For the reason that the reduced rates are discriminatory not only as to traffic of like character moving Intrastate, but as to the same traffic moving Interstate, and against consumers and users of ground limestone and agricultural lime in the states of West Virginia, Maryland, Pennsylvania, Ohio, and other boarder states, all of whose rates were advanced forty (40) per cent and have not been reduced.

Fifth—For the reason that originally the rates were unreasonably low and were not advanced under either the five (5%) or fifteen (15%) per cent advance granted the carriers by the Interstate Commerce Commission prior to the taking of the railroads over by the United States—notwithstanding our application to your Honorable Commission, and the fact that the revenues of the Railways were being depleted by the excessive costs of materials, supplies, coal, equipment, etc., all of which was made known by sworn statements presented by the Railways.

Sixth—For the reason that the rates as advanced under Ex Parte 74 were still much lower than the rates upon agricultural or burnt lime used for the same purpose by farmers.

In support of the above reasons for protest, references made to exhibits filed with your Honorable Commission is this case at the time of the hearing on Dec. 6th, 1920.

Especial attention is called to the fact, that with the exception of Brick, Cinders, Fertilizers, and Slag, for the distance of 10 miles, the rates on ground limestone and marl for acid soil treatment, as advanced under Ex Parte 74 are much lower than are the rates upon commodities of like character, etc.

Attention is also called to the fact that the rates ordered are a greater percentage of the agricultural lime rate than ever prevailed in the establishment of rates upon a percentage of rates upon a commodity of like character, and practically used for the same purpose.

	Agricult'l Lime	Proposed Rate	Percentage
10 miles and under	$0.84	$0.50	59 ½%
11 " to 15 miles	0.98	0.50	50 %
16 " " 25 "	1.12	0.50	45 %
26 " " 30 "	1.26	0.50	40 %
31 " " 40 "	1.40	0.60	43 %
41 " " 50 "	1.54	0.60	39 %
51 " " 60 "	1.50	0.70	46 ½%
61 " " 70 "	1.68	0.70	42 %
71 " " 90 "	1.82	0.70	38 ½%
91 " " 100 "	1.96	0.80	40.8 %
101 " " 110 "	1.96	0.90	46 %
111 " " 120 "	2.10	0.90	43 %
121 " " 130 "	2.10	1.00	48 %
131 " " 150 "	2.24	1.10	49 %
151 " " 170 "	2.38	1.10	46 %
171 " " 205 "	2.52	1.20	47.6 %
206 " " 225 "	2.52	1.30	51.6 %
226 " " 245 "	2.52	1.40	55.6 %
246 " " 260 "	2.52	1.50	59 ½%
261 " " 280 "	2.52	1.60	63 ½%
281 " " 360 "	2.52	1.70	67 ½%

If it is proper that the rates upon ground limestone and ground marl should be lower than upon agricultural lime, then it would seem fair that the ground lime should bear the same relation to agricultural lime that the latter bears to building lime, which is general speaking, twenty (20%) per cent, that is—agricultural lime rates should be twenty (20%) per cent of the Building Lime rates.

We respectfully submit that the Exhibits filed clearly demonstrate the fact that the present rates upon Ground Limestone and Ground Marl—viz., the rates as advanced under Ex Parte No. 74—are not higher than they should be, and that the reduction ordered creates a further discrimination as compared with commodities of like character, as indicated.

(Signed) E. D. HOTCHKISS,
For above railroads, and others.

Ohio Farmers Want Freight Rate Reduction on "Agstone"

The Consumer, Represented by Ohio Farm Organizations, Asks Reduction in Freight Rates on Agricultural Limestone

THE National Agricultural Limestone Association has received the following letter from the Ohio Farm Bureau Federation, addressed to Secretary A. P. Sandles, under date of June 9, 1921, and signed by Harry F. Denig, department of transportation of the Ohio Farm Bureau Federation, Columbus, Ohio:

"Dear Sir:

"In the interest of the farmers of Ohio and public welfare, the Ohio Farm Bureau Federation is preparing to petition the Ohio lines for a reduction in the present rates on agricultural limestone, and if by this method of procedure we are not successful, then to appeal to the Ohio Public Utilities Commission for relief. You could assist in this work materially if you would have the members of your association answer the attached questions.

"Thanking you for your assistance in this matter and hoping you will be able to impress upon your members the importance of furnishing this data at the earliest possible date."

The Questions

"1. Location of plant? 2. Railroad serving plant direct? 3. Railroads serving plant by switching? 4. Range of prices per ton for past five years?

	First Half	Second Half
1917	....	....
1918	....	....
1919	....	....
1920	....	....
1921	....	....

"5. Is your output of agricultural limestone sold f. o. b. plant or destination? 6. What is your investment in the agricultural limestone business? 7. Tonnage and average rate statement, in net tons, by months for the periods of June 25, 1917, to June 25, 1918; June 25, 1918, to August 26, 1920; and, August 26, 1920, to May 31, 1921, for 75 miles and under—No. of cars? Tonnage? Average freight rate? Over 75 miles—No. of cars? Tonnage? Average freight rate? Total—No. of cars? Tonnage? Average freight rate?

"To arrive at the average freight rate, multiply each different freight rate by the number of cars shipped at that rate and divide the sum of the total by the number of cars shipped; divide the total tonnage shipped into the total freight paid."

The Ohio Farm Bureau Federation represents the consumers of agricultural limestone and this appeal for lower rates comes from the farmer, who is affected by the high rates on limestone fertilizer.

The letter quoted is the outcome of conferences held in Columbus, Ohio, on June 3 and June 7, at which representatives of the Ohio Farm Bureau Federation, Ohio State Grange and Ohio State University took part. Two ways of securing a lower rate were discussed: 1. Conference with railroad officials. 2. Appeal to the Ohio Public Utilities Commission.

It was unanimously agreed to ask for a conference with railroad officials. It was also agreed to ask for rate reductions within the state as the organizations present represented the Ohio farmer only.

New England Market Prices

THE GRADUAL improvement in construction operations is showing its effect on the sand, gravel, crushed stone and affiliated material markets in the eastern districts. The tone is far better than that of a month or so ago, and the trend, decidedly, is towards increased consumption of important products, firmer markets and a general feeling of optimism.

Producers in the New York district, New England section, New Jersey and Pennsylvania, are showing greater inclination to go ahead. The revival in building work, comprising for the most part dwelling and apartment construction, the advancing call for materials for road operations, and the betterment of the general business situation are the fundamental factors in making for this attitude. While there is no one so sanguine as to expect normal trade within the next few months, yet the outlook for summer and fall construction is encouraging, and good orders from different quarters are anticipated.

Portland cement at Boston, Mass., is around the $3 mark, in cloth bags, with 10-cent bag rebate prevailing. In paper, the material is a little cheaper. Common lime, 180-lb. net, barrel, is selling for $2.80 at the local supply dealers, and in 280-lb. barrel, at $4.08; finishing lime holds at $3 and $4.35 for the size barrels stated, in order noted. Hydrate common lime is $18.20 a ton in paper, and finishing hydrate lime, $19.50.

Calcined plaster, in 250-lb. barrel, is selling for $4.60 in the Boston market, and in 320-lb. container, at $5.80. Calcined finishing plaster is priced at $4.75 and $6, for barrels of the respective sizes noted. Sand is being quoted in this district at $2.50 a cu. yd., while crushed stone is selling for around $2.50 a ton. Gypsum partition blocks are in fair demand, and are selling at $130 a thousand, 3-in. size, and $150 for the 4-in.

No General Freight Rate Reductions

THE EDITOR OF ROCK PRODUCTS has been informed in New York by representatives of one of the railway executives who took part in the Washington conference, June 2, with producers of crushed stone, sand, gravel, paving brick, etc., that there will be no general reduction of freight rates on these materials. In all probability the matter will be referred to the presidents or traffic managers of the various individual railways to deal with particular cases on their merits.

The railway executives are very reluctant to admit that rates on any specific commodity are, as a general proposition, too high, but they probably will assume the attitude that they are open to conviction in particular instances. In other words, they are somewhat like the proverbial Scotchman "who was perfectly open to conviction, but he would like to see the damn man who could convince him."

However, lower rates from individual traffic executives on the various roads are by no means beyond hope. The New Haven railroad has already made such reductions. Some mineral aggregate producers predict that as soon as the railway men actually wake up to the fact that their high rates and indifference are actually costing them paying business, they will commence rate-cutting in earnest to get the business away from each other. At present they appear to be too well organized to begin cutting.

Montana Law Taxing Cement Attacked

THE CONSTITUTIONALITY of the law levying a tax on cement in Montana is to be attacked by the Three Forks Portland Cement Co. of Trident, it is intimated by the company in paying approximately $10,000 in taxes to State Treasurer J. W. Walker under protest. The payment, for the period from January 1 on represents the sale of approximately 1,000,000 sacks of cement, or 250,000 barrels. The tax is 4 cents a barrel.

The company protests on the ground that the tax cannot be made retroactive from March 5, when the bill creating the tax was signed, and on the further grounds that the whole law is contrary to the constitution.

Some of the other concerns coming under the act—coal, oil and cement—are also paying under protest.

Editorial Comment

Nothing Ever New

Since the article on the Fonda Lime Works (St. Albans, Vt.) was published in the June 4th issue of Rock Products, the editor has learned that the method of spraying water *continuously* on the furnace fire in connection with the use of forced draft, is no new stunt. It has been tried before and abandoned; because, it was said, the water spray interfered with the draft.

Nevertheless we feel sure these examples of practice in lime burning are interesting and valuable. Too often a method or a process is tried out and abandoned without having been sufficiently considered to know whether its failure was due to the process itself or to some other condition or circumstance that might have been corrected.

The lime industry has been a notable example of an industry in which many individual experiments have been made, much valuable information gained, but because this information was never made public and other viewpoints gained, this priceless experience was wasted.

Some things we publish in Rock Products are by no means intended as guides to the best practice of lime burning, but are purely descriptions of methods of how *it is done* in certain instances. We will always be more than glad to have our readers comment or criticize practices which we describe, and thus give other producers some of the benefits of their expereince. More than anything else, if it is to be a really scientifically conducted industry, the lime industry needs this interchange of experience and ideas.

Big vs. Little Operations

The article on "Exploration of Limestone Deposits," by Joel H. Watkins, in the June 4th issue of Rock Products, has certainly given the lime industry something to think about. Taken as a whole it is almost an indictment of the lime industry as at present conducted. Nevertheless, there are some things stated in this article that are not altogether in line with our own observations and experience.

Particularly, we do not agree with his statement, "It is needless to say that a plant of small capacity will never be able to produce lime as economically as a plant of large capacity and of modern design." Our own observation of conditions in the lime industry is that the economically operated small lime plant makes more money in proportion to the capital invested than most large operations.

The small operation of any kind, provided it has a manager at its head who knows his business, has the great advantage of personal management. Any one experienced with labor, which is the big element in quarrying and lime-manufacturing operations, knows that nearly always better relations exist in the case where the proprietor comes in actual contact with his employes, than in large operations where the labor relations are not so personal.

Another big item in lime manufacture is fuel. Every lime man knows that it is possible to get just as good fuel economy in a small operation as a large one. The principles of efficient kiln operation apply equally to all sizes and kinds of kilns. The small operator with his own management of the plant, provided he is sufficiently posted on that phase of his industry, is capable of making just as many pounds of lime per pound of fuel as the big fellow with all his improvements.

There is not such a tremendous difference in quarrying costs between large and small operations, as would appear at first glance. Large quarry operations are fully as apt to be inefficiently conducted as small ones. Most experienced quarrymen will tell you that the small quarry operated on the piecework system is to all practical purposes a near competitor of the operation three or four times as large. When the capacity gets up into thousands of tons per day, of course the difference in quarrying costs are much larger, but it is a very large lime operation that uses 2,000 tons of stone per day.

The quality of lime depends both on the quality of the stone and the care in the kiln operation, so comparisons are difficult, but we can see no reason why with the same stone a small plant cannot make just as good lime as the large one. Here again personal management in the case of the small plant often overcomes superior equipment of the larger operation.

It is true, of course, that the large operation, properly financed, is capable of promotional work and sales organization that the little operator cannot have. And what the lime industry needs now is just that intensive promotional work. But the little operator cannot and should not be eliminated. He is just as necessary to the lime industry as anyone.

Limestone is so widely distributed that no group of lime manufacturers or financial interests can ever hope to corner the supply of raw material. The whole tendency at present, because of high transportation costs, is to decentralize those industries that can be decentralized, or localized. With the wide distribution of fuel and limestone in this country of ours it would take a far greater margin of economy in large operations over small operations to offset the difference in present freight rates on the finished product for short hauls and for long hauls.

Instead of threatening them with extinction the day is no doubt coming when there will be more small operations but more efficient ones.

Accident Prevention

Handling Men

By W. Dean Keefer, Safety Engineer, National Safety Council

FOR THE FOREMAN to obtain highest efficiency from his men it is important that each one clearly understands all about the job he is doing, and its relation to other jobs in the plant, and the important part his particular job plays in producing the article made by the company. The foreman should keep in mind that the first few days or weeks are hardest for the new man; no matter how skilled he may be, it is well to give him special thought and attention during that period to accustom him to his new surroundings and to make him feel at home.

Foremen as Examples

In some organizations the workmen seldom see the superintendent, the manager, or other officers of the company and they often form their opinions of these officials of the company as a whole by what they think of their foreman. To the workmen, the foremen are the representatives or agents of the company and it is as much to the foremen's interest as to that of the company to make their opinion a good one. The foreman's attitude will be reflected throughout his department, not only because his men will reflect his ideas, but also because most foremen select those workmen whose thoughts and efforts most nearly coincide with theirs. Foremen are not only the teachers of their men, but are also their examples. If they are not fundamentally loyal, dependable, and honest, both inside and outside the plant, they cannot expect to see these characteristics in their men.

Introducing New Ideas

Care should be exercised in introducing new ideas and changes into shop methods, especially when they affect any of the workmen. Many workmen object to changes which they would have favored if only they had been asked or told about them beforehand. Tell the men affected why a change is made, point out its advantages, and then it is reasonable to expect them to receive the change kindly, especially if they know it will not hurt them financially or otherwise.

Workmen of Foreign Descent

Some industries keep men of the same nationality or race together in one corner of the shop. When this is done, the men may get together and talk about some fancied grievance in their own language until in their opinion it grows to be a great injustice. The grievance may look bigger to them because of some national characteristic which they possess. They will naturally all have the same viewpoint, and when once convinced that they have a grievance, it will be difficult to persuade them to the contrary. A better plan, in the opinion of the National Safety Council, is to have men of different nationalties work together with a sufficient sprinkling of native Americans so that general spirit of the working force will be American. Furthermore, the mixing of different nationalities makes it possible for each nationality to appreciate the virtues of the other and many workmen of foreign descent will be influenced, who perhaps could not be reached in any other way.

Often the foreman is the first example of Americanism that a workman can see and imitate. Some foremen help the workmen in filling out their naturalization papers. Give all of your men, no matter what their nationality may be, every chance to be good workers, to be good citizens, and to consider work under you as a training in citizenship as well as in industrious habits.

Obtaining New Workmen

It is often a good plan to obtain new workmen from the recommendations of men already in the employ of the company who have proved they possess the proper qualifications. A good workman is not likely to recommend someone who would prove unsatisfactory, because he would feel that in so doing he would hurt his own reputation. A man of good habits is not likely to recommend one who is very different from himself. It is of considerable advantage to place relatives and friends of satisfactory men in the same shop, but they should not be placed under the authority of a relative or friend, nor should they be placed so they are working together. If scattered through the shop, their characteristics may be an influence for good among other members of the working force.

Who Is Your Ideal Executive

Many foremen have guided their actions by thinking "What would HE do if he were in my job," he meaning "the old man" who has endeared himself to everyone; perhaps the manager or superintendent of the plant. Just imagine him up against our problems; what would HE do? The foremen are his representatives, his agents, and their thoughts and actions should be as nearly like his as possible. They should act and do the same thing he would do if he were in their position. The foreman may not always do it, but he should make a great effort toward it.

Summary

Successful foremen possess not only mechanical and executive ability, but also the power to inspire confidence and co-operation among their workmen.

The system of leading workmen is much more effective than driving them.

Be the friend and advisor of your men.

Use tact to become a "partner" rather than a slave driver.

Work for continuous agreement rather than temporary obedience.

Be sincere, frank, and truthful.

Do not tolerate favoritism.

Take pride in your ability to develop men.

Workmen may succeed simply because they know you believe in them and have confidence in their ability.

You can reason with your workmen, but never try to "break them in." Teach them and give special attention to new men.

Workmen are greatly influenced by the ideas and attitude of their foremen; foremen therefore must be examples in those characteristics which they expect to see in their workmen.

Gain the support of your workmen by explaining to them new ideas and changes.

Do not segregate men of different nationalities; scatter them through your shop and make the general spirit of the working force American.

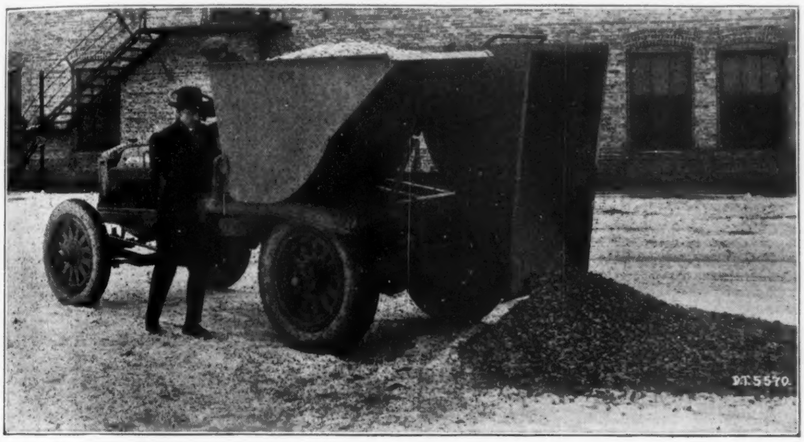
It is a good plan to employ friends or relatives of satisfactory workmen, but exercise care in assigning their work.

Guide your thoughts and actions by what you think your manager would do if he were in your position.

New Machinery and Equipment

New Contractors' Truck for Handling Mineral Aggregate

AS EVIDENCE of the increasing demand for road-building equipment the Diamond T Motor Car Co., of Chicago, Ill., has brought out a new "Contractors' Special" truck. The manufacturers claim that this truck will fill a long-felt want for a truck especially adapted for handling road-building materials. It is also claimed that this type of truck has proven that it will save from 25 to 50 per cent over the older, conventional methods of distributing sand, gravel and crushed rock where equipment used varies from 1 to 5-ton units.



"Contractors' Special" truck showing position of hoppers before and after dumping

This truck is equipped with dual end dump hoppers constructed of No. 10 gauge steel throughout, each having a capacity of 1 cu. yd., giving a total load capacity of 5,000 to 6,000 lbs. The short wheelbase enables it to turn easily on an 18-ft. sub-grade. It is fitted with pneumatic cord tires 34 x 5 front, 40 x 8 rear, allowing operation on soft ground and protecting subgrade from being broken down. The smaller size tires in front decreases the turning radius, and the weight is supported just as safely as though larger tires were used, because practically all the load is carried on the rear axle. The truck "hook-up" is so designed that the load is properly balanced even when operating on a steep incline.

Simplicity in design has been combined with sturdy, rigid, compact construction, with all non-essential accessories eliminated. Lamps have been removed; a step bracket takes the place of the step board. It has a single seat only, the space usually used for the second occupant being taken up with a large, roomy receptacle for tools. Standard equipment includes radiator guard and one tow hook front and rear. Frame cross members have been placed to give hoppers proper support. The motor is a heavy-duty truck motor 4-in. bore by 5¼-in. stroke, developing 43 h.p. The carburetor is equipped with air strainer to prevent dust from entering combustion chamber and scouring the cylinders and bearings. All moving parts are completely housed and protected from dust, dirt and grit. A metal shield mounted between central members of hopper carrier protects the worm housing and universal joints from the hopper overflow. The hoppers travel on a studded track, insuring proper alignment at all times.

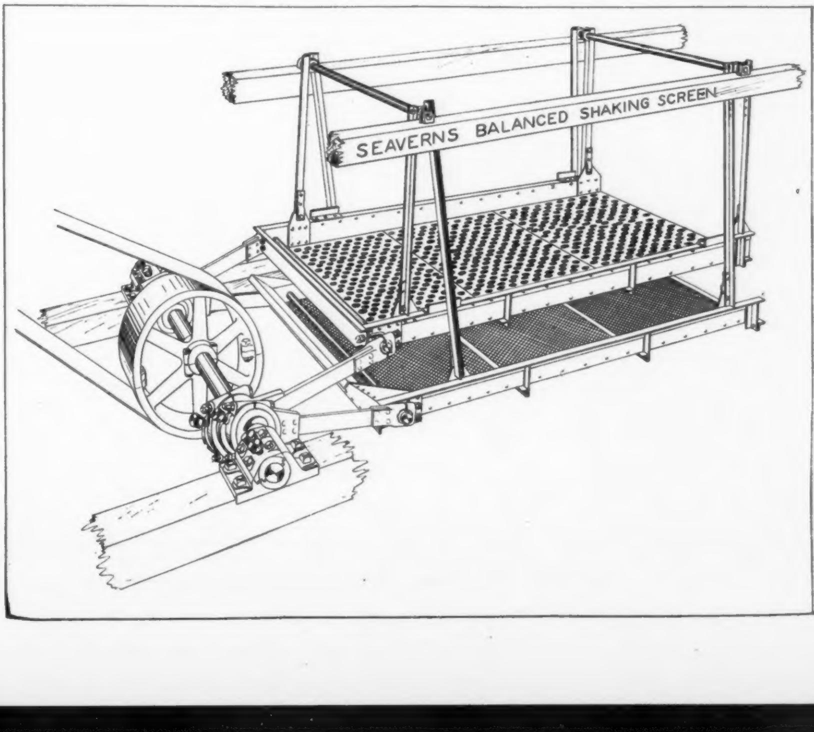
Auxiliary springs carried on each frame member and resting on spring box prevents spring rebound.

The Seaverns Balanced Shaking Screen

A PRACTICAL type of shaking screen for severe service is the horizontally balanced type shown in the accompanying view. These screens are made by the James B. Seaverns concern, Chicago, Ill. The screen is very rugged in construction of the eccentric shaft, bearings, etc., while the swinging frames or reciprocating parts are proportioned so as to keep them comparatively light while yet strong enough for long life. Another advantage in these screens is the simple method with which they may be installed. In the majority of cases the hangers are mounted directly beneath the main stringers of the big revolving screens. These hangers are adjustable and may be made to suit any required position or pitch of screen.

The standard size of decks or frames is 5 ft. by 10 ft. and gives a capacity of about 75 to 80 tons of stone per hour. There are three separate products obtained in using the standard screen, although two grades may be made if desired.

The use of light steel castings, phosphor bronze split bushings with take-up adjustments and plenty of lubricating facilities are a few points of detail built into these screens that go a long way toward the low cost of their operation.



The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.35	1.35	1.25	1.25	....
Buffalo, N. Y.		1.30 per net ton, all sizes				
Burlington, Vt.	**1.00**	....	**2.50**	**2.00**	**2.00**	....
Chaumont, N. Y.	1.75	1.75	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	....
Coldwater, N. Y.		1.50 per net ton, all sizes				
Eastern New York	.90	1.80	1.70	1.60	1.60	1.50
Eastern Penna.	1.00	....	1.85	1.85	1.85	1.85
Munns, N. Y.	1.00		Other sizes 1.50			
Walford, Pa.	1.40	1.60	1.75	1.75	1.60	1.60
Western New York	.70	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alden, Ia.	.80@1.00	.80@1.00	1.50	1.45	....	....
Alton, Ill.	2.00	....	1.50	1.50	....	....
Bettendorf, Ia.		All sizes, 2.00 cu. yd. f.o.b. quarry				
Brillion, Wis.	1.00	....	1.20	1.00	1.00	....
Buffalo, Ia.	1.00	1.35	1.45	1.25	1.35	1.35
Chicago, Ill.	1.20	1.60	1.20	1.20	1.20	1.20
Columbia, Ill.	**2.15**	**1.90**	**2.00**	**2.00**	**1.90**	**1.90**
Dundas, Ont.	1.00	1.50	1.50	1.50	1.25	1.20
Eden and Knowles, Wis.	1.30	1.30	1.30	1.30	1.30	....
Greencastle, Ind.	1.50	1.35	1.25	1.10	1.10	1.10
Illinois, Southern	1.75	1.60	1.60	1.50	1.60	....
Kokomo, Ind.	1.10	1.25	1.25	1.10	1.10	1.10
Krause or Columbia, Ill.	1.80	1.30	1.50	1.40	1.30	1.30
Lannon, Wis.	1.00	1.10	1.10	1.10	1.10	1.10
Marblehead and Brillion, Wis.	1.10	....	1.20	1.10	1.10	....
Montrose, Ia.	1.35	1.75	1.75@1.85	1.75	1.65@1.75	....
Oshkosh, Wis.		**1.40 per ton, all sizes**				
River Rouge, Mich.	1.50	1.65	1.65	1.50	1.50	1.50
Sheboygan, Wis.	1.25	1.25	1.25	1.25	1.25	1.25
Stolle, Ill. (I. C. R. R.)	1.75	1.60	1.60	1.50	1.50	1.50
Stone City, Ia.	.80	....	1.50	1.40	1.30	....
Toronto, Canad	1.90	2.40	2.40	2.40	2.15	2.10
		These prices include 90c freight				
SOUTHERN:						
Cartersville, Ga.	....	1.85	1.60	1.60	1.60	....
Chickamauga, Tenn.	1.00	1.00	1.25	1.00	1.00	1.00
Chico, Texas	1.10	....	1.25@1.50	....	1.25	....
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	....
Fort Springs, W. Va.	1.40	1.60	1.75	1.75	1.45	....
Garnet and Tulsa, Okla.	....	....	1.60	1.60	1.45	....
Ladds, Ga.	1.75	1.75	1.75	2.00	2.00	....
New Braunfels, Tex.	.60	1.50	1.50	1.25	1.25	1.25
Portland, Ga.	.60@ .75		All other sizes 1.60@1.75			
WESTERN:						
Atchison, Kans.	.50	2.10	2.10	2.10	2.10	2.10
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.60@1.65	1.45@1.50	1.40
Cape Girardeau, Mo.	1.50	....	1.50	1.50	1.25	....
Kansas City, Mo.	1.00	2.00	2.00	2.00	2.00	2.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Baltimore, Md.	1.25	2.50	2.35	2.25	2.00@2.25	2.00
Bernardsville, N. J.	**2.00**	**2.20**	**2.00**	**1.80**	**1.50**	....
Branford, Conn.	.80	1.95	1.80	1.60	1.40	....
Bound Brook, N. J.	2.00	2.30	2.00	1.70	1.60	....
Dresser Jct., Wis.	1.00	2.45	2.45	2.30	2.00	....
Duluth, Minn.	.75@1.00	2.25	1.90@2.00	1.40@1.50	1.40@1.50	1.50
Dwight Station, Calif.			.75@1.00—all sizes			
E. Summit, N. J.	2.10	2.35	2.15	1.75	1.75	....
Eastern Mass.	.60	1.95	1.75	1.50	1.50	1.50
Eastern New York	.90	1.80	1.70	1.60	1.60	1.50
Eastern Penna.	1.60	2.25	1.95	1.80	1.80	1.70
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@1.00	1.60@1.80	1.60@1.80	1.40@1.50	1.20@1.30	....
Oakland, Calif.	1.75	1.75	1.50	1.50	1.50	1.50
Richmond, Calif.	.50*	....	1.75*	1.50*	1.50*	....
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Springfield, N. J.	2.00	2.40	2.10	1.80	1.75	1.75
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Ableman, Wis.	1.60	....	1.30	1.50	1.20	....
Alexandria Bay, N. Y.	1.60	....	1.30	1.50	1.20	....
Berlin, Wis.	1.60	....	1.40	1.50	1.30	....
Columbia, S. C.—Granite	.75	....	2.75	2.50	2.35	....
Dell Rapids, S. D.	1.00	....	2.10	2.10	2.10	....
Dundas, Ont.—Flint	1.10	1.10	1.10	1.10	1.10	1.10
Eastern Penna.—Sandstone	1.10	2.00	2.00	1.70	1.70	1.70
Eastern Penna.—Quartzite	.90	1.70	1.55	1.30	1.30	1.10
Holton, Ga.—Granite	.40	....	2.50	2.25	2.25	2.00
Lohrville, Wis.	1.60	....	1.30	1.50	1.20	....
Los Angeles, Cal.—Granite	....	1.25@1.50	1.15@1.40	1.15@1.40	....	....
Macon, Ga.—Granite	.50	....	2.50	2.25	2.00	2.00
Middlebrook, Mo.—Granite	3.50@4.00	....	....	2.00@2.25	....	1.25@1.75
Sioux Falls, S. D.	1.00	....	2.00	2.10	2.00	....
Red Granite, Wis.	1.60	....	1.30	1.50	1.20	....
Stockbridge, Ga.—Granite	.50	2 00	1.90	1.75	1.75	....
Utley, Wis.	1.60	....	1.30	1.50	1.20	....

***Cubic yard. †Agrl. lime. ||R. R ballast. §Flux ‡Rip-rap. a 3-inch and less.**

Agricultural Limestone

EASTERN:	
Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.50; bulk	2,75
Coldwater, N. Y.—Analysis, 56.77% $CaCO_3$, 41.74% $MgCO_3$, 70% thru 200 mesh, 95% thru 50 mesh, sacks 4.00; bulk	3.00
Grove City, Pa. — Analysis, 94.75% $CaCO_3$, 1.20% $MgCO_3$ — 70% thru 100 mesh; 80 lb. ppr., 5.50; bulk	4.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$, 5.25% $MgCO_3$; sacks, 4.50; bulk	2.75
New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.50; bulk	3.00
Syracuse, N. Y. — Analysis, 90% carbonates—50% thru 100 mesh, 90% thru 50 mesh; sacks, 3.50; bulk	2.75
Texas, Md.—Analysis, 58.02% $CaCO_3$, 37.3% $MgCO_3$—50% thru 50 mesh; bags, 4.25; bulk	2.50
Walford, Pa. — 50% thru 100 mesh, 60% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk	3.00
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$ — 90% thru 100 mesh; paper bags, 6.25—90% thru 50 mesh; paper bags, 5.25; bulk	3.25
West Stockbridge, Mass.—Analysis, 95% combined carbonates; 33% thru 200 mesh, 66% thru 100 mesh, 100% thru 20 mesh; sacks 5.25@5.50; bulk	3.25
Williamsport, Pa. — Analysis, 88-90% $CaCO_3$, 3-4% $MgCO_3$—50% thru 50 mesh; paper, 5.50; bulk	4.00
CENTRAL:	
Alden, Ia.—Analysis, 99.16% $CaCO_3$	.80
Alton, Ill. — Analysis, 96% $CaCO_3$, 0.3% $MgCO_3$—50% thru 4 mes.	4.50
Bedford, Ind. — Analysis, 98.5% $CaCO_3$, .5% $MgCO_3$—90% thru 10 mesh	1.60@2.00
Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Buffalo, Ia.—90% thru 4 mesh	1.00
Cape Girardeau, Mo.—Analysis, 90% $CaCO_3$, .044% $MgCO_3$—50% thru 4 mesh	1.50
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh	1.50
Columbia, Ill., near East St. Louis—⅛-in. down	1.25@1.80
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$—50% thru 50 mesh	1.25
Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh	2.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—90% thru 50 mesh	2.00
Marblehead, O.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$—52.4% thru 100 mesh, 59% thru 50 mesh, 100% thru 10 mesh; sacks, 5.25; bulk	3.00
Limestone screenings; bulk	1.50
McCook, Ill.—Analysis, 54.10% $CaCO_3$, 45.04% $MgCO_3$—100% thru ¼-in. sieve, 78.12% thru No. 10, 53.29% thru No. 20, 38.14% thru No. 30, 34.86% thru No. 50, 22% thru 100	1.50
Milltown, Ind.—Analysis, 91.59% $CaCO_3$, 4.87% $MgCO_3$ — 24% thru 200 mesh, 33.6% thru 100 mesh, 40% thru 50 mesh, 50% thru 40 mesh, 70% thru 20 mesh	1.65
Mitchell, Ind.—50% thru 100 mesh	2.00
Montrose, Ia.—90% thru 100 mesh	1,25
Ohio (different points), 20% thru 100 mesh; bulk	1.50@1.75
Piqua, O. — Analysis, 82.8% $CaCO_3$, 8.2% $MgCO_3$; neutralizing power in terms of calcium carbonate, 95.3%—50% thru 100 mesh	3.25@5.00
50% thru 50 mesh	1.75@2.00
Ridgeville, Ind.—Analysis, 98% $CaCO_3$ 100% thru 4 mesh	1.75
River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@1.40
Spring Valley, O. — Analysis 95.92% $CaCO_3$, 2.15% $MgCO_3$; 100% thru 10 mesh, bulk	3.00
Stolle, Ill., near East St. Louis on I. C. R. R. — Thru ⅛-in. mesh — Analysis, 89.61% to 89.91% $CaCO_3$, 3.82% $MgCO_3$	1.75

(Continued on next page.)

Agricultural Limestone

(Continued from preceding page.)

Stone City, Ia.—Analysis, 98% $CaCO_3$—90% thru 50 mesh	.80
Toledo, O.—Analysis, 52.72% $CaCO_3$, 43% $MgCO_3$—20% thru 100 mesh, 30% thru 50 mesh, 80% thru 100 mesh, 100% thru 5/32 screen	1.80
Whitehill, Ill.—Analysis, 97.12% $CaCO_3$, 2.50% $MgCO_3$—90% thru 100 mesh	5.00
50% thru 50 mesh	2.00
Yellow Springs, O.—Analysis, 96.08% $CaCO_3$, .63% $MgCO_3$—32% thru 100 mesh, 58% thru 50 mesh, 99% thru 10 mesh; sacks, 8.25; bulk	5.25
SOUTHERN:	
Blowers, Fla.—Analysis, 98% combined carbonates—75% thru 200 mesh	5.00
Cartersville, Ga.—Analysis, 96% combined carbonates—pulverized limestone	1.75@2.00
Claremont, Va. (Marlime)—Analysis, 90% $CaCO_3$, 2% $MgCO_3$—90% thru 50 mesh; bulk	3.50
Dittlinger, Tex.—Analysis, 99.09% $CaCO_3$, .04% $MgCO_3$—90% thru 100 mesh	2.00@3.00
90% thru 4 mesh	1.00@2.00
Grovania, Ga.—Analysis, 95% $CaCO_3$, no $MgCO_3$—50% thru 100 mesh	2.50
Hopkinsville, Ky.—Analysis, 94.6 to 98.1% $CaCO_3$; bulk	2.00
Knoxville, Tenn.—Pulverized	2.50
90% thru 100 mesh	2.00
90% thru 50 mesh	1.50
Ladds, Ga.—Pulverized limestone	2.50
Linnville Falls, N. C.—Analysis,, 53% $CaCO_3$; 42% $MgCO_3$—50% thru 100 mesh; sacks, 4.50; bulk	3.00
Mascot, Tenn.—Analysis 52% $CaCO_3$, 38% $MgCO_3$.	
80% thru 100 mesh	3.00
All thru 10 mesh	2.50
80% thru 200 mesh	5.00
Paper bags, $1.50 extra per ton; burlap, $2.00 extra per ton.	
Maxwell, Va.	2.50
Mountville, Va.—Analysis, 76.6% $CaCO_3$, 22.83% $MgCO_3$—100% thru 20 mesh; 100 lb. ppr., 7.00; bulk	5.00
Ocala, Fla.—Analysis, 98% $CaCO_3$—75% thru 200 mesh	4.50
WESTERN:	
Colton, Calif.—Analysis, 95% $CaCO_3$, 1½% $MgCO_3$—all to pass 14 mesh; bags, 6.50; bulk	5.50
Sacks, 15c extra, returnable.	
Garnett, Okla.—Analysis, 86% $CaCO_3$, 50% thru 4 mesh	.50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk	2.00
Terminus, Calif.—Analysis, 96.2% $CaCO_3$, .04% $MgCO_3$—60% thru 200 mesh, 90% thru 100 mesh, 95% thru 50 mesh, 100% thru 4 mesh; sacks, 6.00; bulk	5.25
Tulsa, Okla.—90% thru 4 mesh	.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:	
Beach City, O.—Washed and screened	3.00
Berkeley Springs, W. Va.	2.25@2.50
Cedarville and South Vineland, N. J.	2.00
Cheshire, Mass.	5.00@7.00
Columbus, Ohio	**2.50@3.00**
Gray Summit, Mo.	**2.50@4.00**
Hancock, Md.—Damp	2.50@3.50
Klondike and Pacific, Mo.	**2.50@3.00**
Mapleton, Pa.—Dry	2.75
Glass, damp	2.25
Massillon, Ohio	**3.50**
Millington, Ill.	1.75
Mineral Ridge, Ohio	3.00
Montoursville, Pa.—Green, washed	2.00@2.25
Morgantown, W. Va.	**3.00@3.25**
Oregon, Ill.—Large contracts	1.75
Ottawa, Ill.	*1.50@2.25
Pittsburgh, Pa.—Dry, 4.00; damp	**3.00**
Rockwood, Mich.	3.25
St. Marys, Pa.—Green	2.50
Thavers, Pa.—Washed	2.00@2.50
Utica, Ill.	1.75@2.25
FOUNDRY SAND:	
Ableman, Wis.—**Brass molding and molding fine**	**3.00**
Albany, N. Y.—Glass and sand blast	2.00@7.00
Core	1.50@2.50
Furnace lining	2.50@3.00
Molding fine, coarse and brass	2.00@2.75
Allentown, Pa.—Core	**1.50@1.75**
Molding coarse	**1.50@1.75**
Arenzville, Ill.—Molding fine	1.40@1.60
Beach City, O.—Core, washed and screened	**2.00@2.50**
Furnace lining	**2.50@3.00**
Molding fine and coarse	**2.25@2.50**
Bowmantown, Pa.—Core	**1.35@1.50**
Molding, coarse	1.80@2.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Attica, N. Y.	.75	.75	.75	1.00	1.00	1.00
Buffalo, N. Y.	1.10	.95	.85	.85	.85	.85
Erie, Pa.		1.00		1.65		1.75
Farmingdale, N. J.	.48	.48	1.75	1.75	1.50	
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.60@ .75	2.00	1.75	1.65	1.50
Ludlow, Mass.	.75*	.75*	1.70		1.50*	1.50*
Philadelphia, Pa.	.75	.75		1.65	1.50	
Pittsburgh, Pa.		1.30	1.30	1.30	.85	.85
Portland, Maine		.50@ .60		1.50		1.35
Texas, Md.		1.00		Pure white sand, 1.50		
Washington, D. C.	.75	.75	2.00	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.50		1.00		1.00
Attica and Covington, Ind.	.90	.90	.90	1.00	1.00	1.00
Barton, Wis.		.60	.70	.70	.70	.70
Beloit, Wis.		.60	.60		.60	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, O., and vicinity	.65	.60	.85	.85	.85	.85
Columbus, O.	.90	.90@1.25	1.25	.90@1.25	.90@1.25	.90@1.25
Des Moines, Ia.	.90	.65	1.60	1.60	1.60	1.60
		25% gravel, .90; 50% gravel, 1.15				
Detroit, Mich.	.65	.65	.95	.95	.95	.95
Earlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	.50	.50	1.00@1.25	1.00	1.00	
Elgin, Ill.		.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.70	.58	.90	.90	.72	.72
Estill Springs, Ky.	1.15	1.15		1.00		.90
Grand Rapids, Mich.		.55		.90	.85	.85
Greenville, Mechanicsburg, O.	.80	.70	.80	1.00	.85	.80
Hamilton, O.		.90			.90	
Hawarden, Ia.		.70			1.60	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Le Mars, and Doon, Ia.		.90		1.80		
Libertyville, Ill.		.75		.75		
Lincoln, Neb.	Sand .40, sand and gravel .80, drained for shipment					
Mason City, Ia.	.90	.80	1.90	1.80	1.70	1.65
Milwaukee, Wis.	1.30	1.30	1.40	1.40	1.40	1.40
Minneapolis, Minn.	.50	.50	1.50	1.50	1.50	1.50
Moline, Ill.	.70	.70	1.20	1.20	1.10	1.10
Oxford, Mich.		.25		.60	.50	.50
St. Louis, Mo., f. o. b. cars	1.60	1.65	1.80	1.60		1.55
Summit Grove, Clinton, Ind.	.90	.90	.90	1.00	1.00	1.00
Terre Haute, Ind.	1.00@1.25	1.00	1.25	1.25	.90@1.25	.90@1.25
Winnipeg, Man.	1.90	1.90		3.25		2.85
Winona, Minn.	.70	.60	2.00	1.75	1.50	1.25
Yorkville, Moronts, Oregon and Sheridan, Ill.	.70@ .80	.70@ .80	.80@ .90	.70@ .80	.70@ .80	.70
SOUTHERN:						
Alexandria, La.	.60@ .90					1.65@1.85
Charleston, W. Va.			Sand 1.40—Gravel 1.50			
Ft. Worth, Tex.	**2.00@2.25***	**2.00@2.25***	**2.75@3.00***	**2.75@3.00***	**2.75@3.00***	
Greenville, Miss.		1.10				1.00
Jedburg, Mo.		1.05	1.20	1.00	1.00	.95
Knoxville, Tenn.	1.15	1.15		2.15	1.95	1.75
Lake Weir, Fla.		**.75**				
Macon, Ga.		.75@1.00				
Memphis, Tenn.	**1.40**	**1.40**	**1.50**			**1.50**
N. Martinsville, W. Va.		1.30		1.40		1.00
New Orleans, La.	**1.00**		**1.75**		**1.25**	
Pine Bluff, Ark.	1.25	.92	Washed gravel, all sizes, 2.30			
Roseland, La.				1.25		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	**(Kaw River sand, car lots, .75 per ton, Missouri River, .85)**					
Niles, Calif.	1.00	1.00	1.40	1.00	1.00	1.00
Pueblo, Colo.	1.25*	1.00*			1.50*	
San Diego, Calif.		.80@1.00	1.30@1.60	1.25@1.55	1.15@1.45	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.50*	1.50*	2.00*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel 2 inch and less
Attica, Covington, Silverwood, Ind., and Palestine, Ill.	.75	.75	.75	.75	.75	.75
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Ia.			.80 per ton—1.20 washed			
Detroit, Mich.	1.10*					
Dudley, Ky. (Crushed Sand)		1.05		1.00		
Elkhart Lake, Wis.			Washed gravel .66			
Fishers, N. Y.	.65@ .85	.75@ .85				.65@ .85
Ft. Jefferson, Mechanicsb'g, O.	**.70**	**.60**	**.60**			
Glenville, N. Y.				1.00*		
Hamilton, O.			6 in. and less, .20 per ton			
Hartford, Conn.		**1.00***				
Hersey, Mich.		.60	.60	.60		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Janesville, Wis.		.65			.65@ .75	
Lindsay, Tex.						.60
Oxford, Mich.					.50	
Pine Bluff, Ark.			Road gravel .60			
Roseland, La.		.75				
Saginaw, Mich., f. o. b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			60% gravel, 40% sand 1.70			
Summit Grove, Ind.	**.65**	**.65**	**.65**	**.65**	**.65**	**.65**
Valde Rouge, La.						**.85**
Waco, Texas		**.80**		**1.50**		**1.30**
Yardville, N. J.		**.50@ .75**				
York, Pa.		1.10@1.20		(crushed rock sand)		

***Cubic yard. B Bank. L Lake. || Ballast.**

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.10	2.50	1.35	1.25	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Erie, Pa.	2.35	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.		1.25	1.25	1.25	1.25	1.25	1.25
Lebanon, Pa.	**2.50**	**.85**	**1.50**	**.85**	**.85**	**.85**	**.85**
Sharpsville and West Middlesex, Pa.	**2.00**	**1.30**	**1.70**	**1.30**	**1.30**	**1.30**	**1.30**
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.			All sizes, $1.50, F. O. B. Chicago				
Detroit, Mich.			All sizes, 1.65, F. O. B. Detroit				
Ironton, O.	2.40		other grades 1.75@2.00				
Jackson, O.	2.00	1.35	1.70	1.35	1.35	1.35	1.35
Stuebenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	2.20	1.70	1.95	1.95	1.95	1.70	1.70
Youngstown, Dover, Hubbard, Leetonia, Struthers, Steubenville, Lowellville & Canton, O.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.85@1.00	.85@ .90
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.00@1.25	1.15	1.05@1.10	.95@1.00	.85@ .90
Longdale, Goshen, Glen Wilton & Low Moor, Va.		2.50	1.00	1.25	1.25	1.15	1.05

Agricultural Lime and Hydrate

	—Agricultural Lime— Bulk	Bags	Per Cent CaO	Per Cent MgO	Agricultural Hydrate Bags
EASTERN:					
Adams, Mass.		8.00	58	0.5	
Bellefonte, Pa.	8.50		98.2	.72	11.50
Berkeley, R. I.			**50**	**18**	**15.00**
Branchton, Pa.		5.50			
Cassadaga, N. Y.—Marl		8.00@10.00	48.07	1.08	
Chippewa, Pa.	6.00		78.67	1.33	
Hot Springs, N. C.	3.00	4.50			
Lime Kiln, Md.	8.00				10.75
Lime Ridge, Pa.	**6.00@7.50**		**80.56-62.71**	**3.87-1.96**	
Paxtang and Lemoyne, Pa.	**5.50**		**63**	**3**	
Rockland, Maine		**8.00**	**65**	**1**	
Rosendale, N. Y.	7.00		84	7	6.00
Union Bridge, Md.	**11.00**	**5.50**	**73**	**1**	**13.00**
Williamsport, Pa.	**6.00**	**10.00**	**75**	**3**	**10.00**
West Rutland, Vt.	**4.50**	**7.50**	**68**	**3**	
West Stockbridge, Mass.					**15.00**
Williams and Blue Bell, Pa.		8.25	57	33	11.25
York, Pa.	8.50		92.5	.03	12.00
CENTRAL:					
Alton and Hannibal, Ill.	**11.50**		.95		
Delaware, O.			50.0	5-12	10.00
Knowles and Valders, Wis.	5.00	9.00	55	45	12.50
Marblehead, O.			85.10	12.92	9.50
Mitchell, Ind.					12.50
Sheboygan, Wis.	5.50	8.50	58	40.5	
Woodville, Ohio			49.16	32.43	9.50
SOUTHERN:					
Burns, Tenn.	**9.50**		**96**	**0.54**	**12.00**
Claremont, Va. (Marl.)	**5.00**	**7.00**	**85-95**	**2-5**	
Erin, Tenn.	**7.50@10.00**		**97.82**	**0.12**	
Karo, Va.	8.50		97	1.25	
Knoxville, Tenn.	9.00		98.23		13.00
Staunton, Va.	7.50	8.75	70	10	
WESTERN:					
Colton, Calif.			**97**	**2**	**15.00**
Kirtland, N. Mex.	12.00				
San Francisco, Calif.			98-99	.5-.75	19.50
Tehachapi, Cal.	**12.00@15.00**	**14.00@17.00**	**98**	**1.00**	

Miscellaneous Sands

(Continued from preceding page)

Cleveland, O.—Molding coarse	1.50@2.00
Brass molding	1.50@2.00
Molding fine	1.50@2.25
Core	1.25@1.50
Columbus, O.—Core	.60@2.50
Brass molding	2.50
Sand blast	5.00@5.50
Glass sand	3.00
Molding, fine and coarse	2.00@2.25
Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass Molding	2.15
Dresden, O.—Core	1.50
Molding fine and coarse	1.50@1.75
Brass molding	2.50
Dunbar, Pa.—Glass sand No. 2, damp	3.00
Traction, damp	2.85
Dundee and Chalfants, O.—Sand blast	3.00
Glass, core and traction	2.75
Molding fine and brass molding	2.25
Furnace lining	2.50
Molding coarse	2.00
Eau Claire, Wis.—Core	.75@1.25
Sand blast	3.00@4.25
Traction sand	.50
Falls Creek, Pa.—Glass sand, washed	2.50
Core sand, washed or unwashed	2.00
Furnace lining, unwashed	2.00
Molding fine, washed	2.50
Molding coarse, washed or unwashed	2.00
Sand blast, washed	3.50
Stone sawing, washed	2.50
Traction, washed	2.00
Fleetwood, Pa.—Furnace lining	2.25
Franklin, Pa. and Utica, Pa.—Traction	2.50
Brass molding	2.25
Core	1.50@2.25
Molding fine	2.25
Molding coarse	2.00@2.50
Sand blast	5.00
Greenville, Ill.—Molding coarse	1.50@1.70
Howard, O.—Glass sand	3.00@3.25
Steel molding	2.25@2.50
Joplin, Mo.—Stone sawing and roofing	1.25
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn.—Molding coarse and stone sawing	1.65
Klondike and Gray Summit, Mo.—Molding fine	2.00@2.50
Molding coarse	2.50@3.00
Mapleton, Pa.—Core, furnace lining, molding coarse and brass molding	2.00@2.75
Molding fine	2.25@2.75
Roofing sand	2.00@3.00
Sand blast	1.50@2.00
Massillon, O.—Glass sand, molding fine and coarse, core, and furnace lining	3.00
Traction	2.50
Michigan City, Ind.—Core, glass, traction and brass molding	.60
Millington, Ill. — Glass, core, furnace lining, roofing and stone sawing	1.75
Mineral Ridge, O. — Core, molding, sand blast, roofing, etc., washed, screened (damp)	2.25
Montoursville, Pa.—Core and traction	1.00@1.50
Brass molding	1.25@2.00
New Lexington, O.—Molding fine	2.25
Molding coarse	2.00
Sand blast	3.00
Glass, core and traction	2.75
Furnace lining	2.50

Miscellaneous Sands

(Continued)

Brass molding	2.25
Oregon, Ill.—Core and glass sand	2.00
Furnace lining	2.00
Molding fine and coarse	1.00
Sand blast	3.50
Stone sawing	2.00
Ottawa, Ill.—Crude silica sand	1.00@1.50
Core, molding, fine and coarse	1.00@2.25
Furnace lining	1.25@2.00
Roofing and traction	1.50@5.00
Sand blast and stone sawing	4.00@5.00
Ottawa, Minn.—Core	2.00@2.50
Glass, molding coarse, roofing, stone sawing (all crude silica)	1.25
Ridgeway, Pa.—Glass sand, green	2.25
Glass sand, wash	2.50
Molding, fine and coarse	1.20
Rockwood, Mich.—Core	2.75@3.25
Roofing	3.25@3.50
Sand blast	4.00
Round Top, Md. — Glass sand, core and roofing sand; washed, damp	1.75@2.00
San Francisco, Cal.—Glass and roofing	3.00@3.50
Core, molding fine and brass	2.30@2.60
Furnace lining and molding coarse	3.60@4.25
Coarse core sand	3.60@4.25
Sand blast	2.30@3.60
Stone sawing and traction	2.30
Thayer, Pa.—Traction	1.50@1.75
Furnace lining	1.10
Molding fine and coarse	1.10
Core, green	1.75@2.00
Tulsa, Okla.—Sand blast	6.50
Utica, Ill.—Core and furnace lining	1.25
Molding, fine and coarse	1.00
Stone sawing and roofing	1.25
Sand blast	3.50@4.50
Traction	1.75
Warwick, Ohio—Core, furnace lining, molding fine and coarse (dry)	2.50
Same, green	2.25
Wedron, Ill.—Core (crude silica)	1.00@1.25
Molding fine and coarse	1.00@1.25
Furnace lining	**1.25**
West Albany, N. Y.—Molding fine	**2.25**
Molding coarse	**2.25**
Winnipeg, Man., Can.—Roofing sand	**4.00**
Zanesville, Ohio — Molding fine and brass	1.75@2.25
Molding coarse	1.65@2.00
Furnace lining	2.50@2.75
Glass, core and traction	2.75
Sand blast	3.00
Steel molding	2.50
Pulverized silica thru 140 mesh	**8.50**
Thru 200 mesh	**9.50**

Crushed Gypsum

Akron, N. Y.	3.50
Blue Rapids, Kan.	**3.50**
Castalia, O.	3.50
Ft. Dodge, Ia.	3.50@4.00
Grand Rapids, Mich.	3.50
Gypsumville, Man., Can.	3.50
Oakfield, N. Y.	**4.00**
Gypsum, O.	3.50
Port Clinton, O.	4.50
Rapid City, S. Dak.	5.00
Saltville, Va.	**4.50**
Winnipeg, Man., Can.	5.50

(Gypsum) Land Plaster

Akron, N. Y.	4.50
Blue Rapids, Kan.	4.50
Castalia, O.	**6.00**
Bags extra—Jute 3.00; ppr., 1.00.	
Ft. Dodge, Ia.	4.50
Garhutt, N. Y.—Bags extra	**7.50**
Grand Rapids, Mich.	4.50@7.50
Gypsum, O.	4.50
Mound House, Nev.	7.50@8.00
Sacks, .25 extra.	
Oakfield, N. Y.	**7.50**
Los Angeles, Calif.	**12.50**

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	**6.00@8.50**
B.P.L. 65%	**8.00**
Gordonsburg, Tenn.—B.P.L. 68%	**6.00@7.00**
B.P.L. 70%	7.50@8.00
B.P.L. 72%	8.50@10.00
Mt. Pleasant, Tenn.—B.P.L. 75%	8.00@9.00
Paris, Idaho.—2,000 lb. mine run, B.P.L. 70%	**4.50**
Wales, Tenn.—B.P.L. 70%	7.75

Ground Rock

Per 2000-lb. Ton

Centerville, Tenn.—B.P.L. 70%—90% thru 100 mesh	**9.00@10.00**
B.P.L 75% (brown rock)	**12.00**
Mt Pleasant, Tenn — B.P.L. 68%—13% Phosphorus	**7.50@9.00**
14% Phosphorus	**8.00**
B.P.L. 65@70%	**7.00@9.00**
Norwills, Fla.—(Fla. Hard Rock)—B.P.L. 68%	**10.00**

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f.o.b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$ 9.30	$8.40	$8.10	$8.10
24x14	9.30	8.40	8.10	8.10
22x12	10.72	8.70	8.77	9.10
22x11	10.72	8.70	8.77	9.10
20x12	10.72	8.70	8.77	9.10
20x10	11.70	9.60	9.42	9.42
18x10	11.70	9.60	9.42	9.42
18x 9	11.70	9.60	9.42	9.42
16x10	11.70	9.60	9.42	9.42
16x 9	11.70	9.60	9.42	9.42
16x 8	11.70	9.60	9.42	9.42
18x12	11.05	9.30	9.10	9.10
16x12	11.05	9.30	9.10	9.10
14x10	11.05	9.30	8.77	8.77
14x 8	11.05	9.30	8.77	8.77
14x7 to 12x6	10.40	9.00	8.45	......
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$7.50	$7.50	$5.75
22x11	9.10	7.75	7.75	5.75
Other sizes	9.10	8.10	8.45	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

The following are the prices per square for slate, f.o.b. cars quarries, Granville, N. Y., the prices given in each case being for No. 1 Sea Green Roofing Slate:

22x11, 20x12, 20x11, 20x10, 18x12, 18x10, 18x9, 16x12, 16x10	10.20
24x12, 22x12, 16x9, 16x8, 14x12, 14x10	9.90
26x14, 24x14, 22x14, 20x14	9.60
14x9, 14x8, 12x10	9.00
14x7, 12x9, 12x8	8.70
12x7, 11x8, 11x7, 10x8	7.50
12x6, 10x7	7.20

Granulated slate per net ton, f. o. b. quarries, Vermont and New York, 7.50.

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags:

New York (del.)	$2.80
New York, alongside dock, to dealers	2.40
Jersey City (del.)	2.89
Boston	2.86
Chicago	2.17
Pittsburgh	2.17
Cleveland	2.43
Detroit	2.43
Indianapolis	2.43
Toledo	2.49
Milwaukee	2.39
Duluth	2.10
Peoria	2.45
Cedar Rapids	2.51
Davenport	2.47
St. Louis	2.20
San Francisco	3.09
New Orleans	3.36
Minneapolis	2.41
Denver	3.10
Seattle	3.10
Dallas	2.60
Atlanta	2.80
Cincinnati	2.57
Los Angeles	3.21
Baltimore (del.) drayload lots	3.58
Birmingham	3.05
Kansas City	2.55
Montreal	3.44
Winnipeg	3.36

NOTE—Bag charge is generally 10c each.

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	13.00@14.00
Barton, Wis.	14.00
Brighton, N. Y.	17.00
Buffalo, N. Y.	16.50
El Paso, Texas	14.00
Gary, Ind.	11.50@12.00
Grand Rapids, Mich.	15.00
Lancaster, N. Y.	14.50
Michigan City, Ind.	11.00
Miller, Ind.	10.00@10.50
Milwaukee, Wis. (delivered at job)	17.50
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.—Common	15.00
Face	25.00
Redfield, Mass.	15.00
Saginaw, Mich.	14.75
San Antonio, Texas—Common	16.00
Face	24.00
South Dayton, Ohio	16.50
Syracuse, N. Y. (delivered at job)	20.00
F. o. b. cars	18.50
Toronto, Can.	17.00
Washington, D. C.	14.50
Winnipeg, Can. (less $1 trade disc.)	19.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Hydrate per Ton Common
New York	$21.00	$19.00
Chicago	20.00	....
St. Louis	26.00	20.00
Boston	25.25	21.25
Dallas	27.50	25.00
Cincinnati	17.60	16.60
San Francisco	25.40	22.00
Minneapolis	29.00 (white)	22.00
Denver (bbl.)	32.00	....
Detroit	22.00	19.00
Seattle	27.00	....
Los Angeles	30.00	30.00
Baltimore	22.25	17.50
Montreal	30.00	....
Atlanta	22.50	18.00
New Orleans	....	17.00
Winnipeg	....	21.20

	Lump per 200-lb. Barrel Finishing	Lump per 200-lb. Barrel Common
New York	$ 3.50 at plant	$ 3.30*
Chicago	....	1.75
St. Louis	....	2.50*
Boston	3.50	3.25
Dallas	....	3.00†
Cincinnati	....	13.10‡
San Francisco	....	2.25
Minneapolis	1.80	1.50
Denver	1.00 (bu.)	3.20
Detroit	2.00†	1.80†
Seattle	3.25	2.75
Los Angeles	3.00*	3.00*
Baltimore	....	12.75‡
Montreal	15.00‡	....
Atlanta	1.60	1.40
New Orleans	2.75	2.00
Winnipeg	3.20	13.80‡

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Bound Brook, N. J.—Trap rock, carload lots; bulk		2.30
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Green Marble, loose in cars	14.00	12.00
Lincoln, Neb. — Red, white, grey, in bags	....	30.00
Middlebrook, Mo.—Red granite; sacks	30.00@35.00	20.00@25.00
Milwaukee, Wis.	....	10.00@12.00
Missouri river points — Different colors	20.00@25.00	20.00@25.00
Piqua, O.—Marble	8.00@10.00	8.00@10.00
Sioux Falls and Red Granite, Wis.	7.50	7.50
Tuckahoe, N. Y.—White Marble	12.00	12.00
Crushed white stone and marble dust in 100 lb. bags	6.50@12.00	....
Tate, Ga.—White limestone, sacks extra	5.00@ 7.00	5.00@ 7.00
Wausau, Wis.	14.00@18.00	....
Wisconsin and S. Dak. points—Granite, different colors, bulk or sacks	1.50@ 2.00	3.00@ 7.00
Granite dust in bags	6.00	....

Natural Cement

Current price for 500 bbl. or over, f.o.b., exclusive of bags:

Minneapolis (Rosendale)	$2.80
Kansas City (Ft. Scott)	1.60
New Orleans	3.36
Atlanta (Magnolia)—ton	11.00
Boston (Rosendale)	2.35
Cincinnati (Louisville)	2.75

*300-lb. barrels. †Per 180-lb. barrel. ‡Per ton.
NOTE—Refund of 10c per barrel.

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Crude talc	4.00
Cubes	50.00
Blanks, per lb.	.08
Chatsworth, Ga.—Crude talc	8.00@10.00
Ground talc (150-200 mesh), bags	12.50
Pencils and steel workers' crayons, per gross	1.50@ 2.00
Chester, Vt. — Ground talc (150-200 mesh), bulk, 10.50@12.00; bags	12.00@14.00
Emeryville, N. Y.—Crude Talc	4.00
Glendale, Calif. — Ground talc (150-200-mesh	16.00@30.00
(Bags extra)	
Gouverneur, N. Y.—Crude talc	4.00
Ground talc (150-300 mesh)	17.00@24.00
Henry, Va.—Crude talc (lump mine run), per 2000-lb. ton	2.75@ 3.25
Ground talc (20-50 mesh), bags, 7.00@7.50; bulk	5.50@ 6.00
Ground talc (150-350 mesh); bags, 9.50@11.25; bulk	8.00@ 9.75
Johnson, Vt.—Ground talc (20-50 mesh), bulk	8.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	8.50@15.00
(Bags extra)	
Keeler, Calif.—Ground talc (200-300 mesh), bags	18.75@32.00
(Bags extra)	
Los Angeles, Calif.—Ground talc (20-50 mesh) 200-lb. bags	12.00
Ground talc (150-200 mesh) 200-lb. bags	15.00@25.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@18.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	8.50@10.00
Ground talc (150-200 mesh); bags	9.00@16.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	8.50
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@15.00
(Bags extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Florida Soft Phosphate

Raw Land Pebble

	Per Ton
Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

	Per Ton
Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Lakeland, Fla.—B.P.L. 72%	13.50
B.P.L. 60%	6.00

Concrete Brick

Prices given per 1,000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	18.00@20.00	28.00@36.00
Bellow Falls, Vt.	20.00	35.00
Bridgeport, Conn.	31.00	32.00
Buffalo, Niagara Falls and Rochester, N. Y.	21.00	....
Eau Claire, Wis.	20.00	30.00@40.00
Houston, Tex.	....	22.00
Lockport, N. Y.	17.00	....
Milwaukee, Wis.	17.00@18.00	35.00@65.00
Omaha, Neb.	32.00	42.00
Piqua, O.	18.00	25.00
Portland, Ore.	25.00	43.00@73.00
Fancy brick	100.00@150.00	
St. Paul, Minn.	18.00	32.00
Springfield, Ill.	18.00	20.00@25.00
Tonawanda, N. Y.	20.00	....
Virden, Ill.	18.00	20.00@25.00
Winnipeg, Man., Can.	19.00	40.00

News of the Industry

Incorporations

Franche and Co., Montreal, Can., manufacturer of artificial stone, has been registered.

The American Sand and Gravel Co., Los Angeles, Calif., has been incorporated for $50,000.

The Hampton Roads Sand and Gravel Corp., Norfolk, Va., has been incorporated for $200,000.

The Storrington Feldspar Co., Ltd., Kingston, Ont., has been incorporated with a capital of $100,000.

The Magnolia Gravel Co., Dallas, Tex., has been incorporated for $5,100 by Sam Bono, Frank Musso and Ingargiola Dominico.

The Coliseum Cast Stone Co., Bronx, N. Y., has been incorporated for $5,000 by M. Vincelli, M. Londino and S. Jannone.

The M. & S. Sand Co., 419 Market St., Camden, N. J., has been incorporated for $125,000 to deal in sand, gravel, etc.

The Cement Products Co., Renton, Wash., has been incorporated for $15,000 by Lawrence S. Shew and others.

Tanghe Bros., Detroit, Mich., has been incorporated for $25,000, to manufacture concrete brick and deal in stone, etc.

The Tory Hill Sand and Gravel Co., Mechanicsville, N. Y., has been incorporated for $43,000 by G. H. Dulin, C. R. Wendt and C. W. Baker.

The Nepperhan Sand and Gravel Co., Nepperhan, Yonkers, N. Y., has been incorporated for $10,000 by J. A. Rice, T. D. Gleeson and W. H. Thorn.

The California Columbia Marble Quarries, Inc., Stockton, Calif., has been incorporated for $100,000 by H. H. Henderson, T. S. Louttit and Olla Lenfesty.

The Unit Concrete Works, Harrison, N. J., has been incorporated for $100,000 by C. S. H. Fitzgerald, W. L. Goeltz and Wm. Bogen, all of Harrison.

The Mar-Bell Products Co., 500 Main St., Asbury Park, N. J., has been incorporated for $100,000 to manufacture and deal in stone and concrete products.

The Bay State Brick and Stone Co., Haverhill, Mass., has been incorporated for $200,000 by Geo. L. Baldwin, president, and J. D. Curtis, 44 Marsh Ave., treasurer.

The Saluda Crushed Stone Co., Wilmington, Del., has been incorporated for $100,000 by T. L. Crotean, M. A. Bruce and C. H. Maxwell, to deal in rock, crushed stone, etc.

Rice and Benjamin, Inc., Boston, Mass., has been incorporated for $50,000 by S. E. Benjamin, president, and C. F. Rice, treasurer. The company deals in building materials of all kinds.

The Quincy Quarry Owners Producing Co., Boston, Mass., has been incorporated for $250,000 by J. A. Galvin, president; F. A. Hodgdon, 83 Salem St., Malden, treasurer, and D. E. Murray.

The Horicon Sand, Gravel and Tile Co., Horicon, Wis., has been incorporated for $40,000 by E. C. Abell, Jennie Beichl and W. W. Koch, all of Beaver Dam, Wis.

The West Bend Cement Vault Co., West Bend, Wis., has been organized by H. Ciriacks, W. Groth and others to engage in the construction of concrete vaults for burial purposes.

The C. B. & M. Co., Earlville, Chenango County, N. Y., has been incorporated for $50,000 by C. C. Chandler, H. D. Chandler and L. L. Baker. The company will operate stone quarries.

The Washington Pre-Cast Stone Co., Washington, D. C., has been incorporated for $50,000 by E. D. Maxwell, C. A. Hunter and J. A. Mitchell. The company will deal in sand and gravel.

John M. Friend, Inc., Newport, R. I., has been incorporated for $50,000 by M. W. Friend, Wm. M. Pettey and C. F. Harrington, Jr. The company will deal in building materials of all kinds.

The American Kaolin Co., Vincennes, Ind., has been incorporated for $250,000 by P. L. Donie, W. G. Duesserberg and J. A. Kapps. The company will operate stone quarries and gravel pits.

The Henderson Marble and Granite Co., Hendersonville, N. C., has been organized with the following officers: Smith Wood, president and general manager, Spartanburg, S. C.; Thos. Shepherd, secretary and treasurer, Hendersonville, N. C.

Quarries

The Rowan County Freestone Co., Farmers, Ky., of which H. Van Antwerp is president and manager, will rebuild plant lately burned at a loss of $50,000, and new plant will have a capacity of 300 cu. ft. of sawed building stone per day.

The American Granite Corp., Houston, Texas, which has just been organized with a capital stock of $350,000 plans to open and develop a large granite quarry near Llano. It is stated that the latest improved machinery for quarrying and dressing the stone will be installed. The officers of the company are: H. S. Fox, Jr., president; J. H. Kirby, vice-president, and Phil Stillman, secretary-treasurer. The directors are: H. S. Fox, Jr.; J. H. Kirby, O. S. Carlton, W. Weatherford, Bassett Blakely, R. E. Goree, Phil Stillman and J. B. Nelson, all of Houston.

Sand and Gravel

The Rogers Sand Co., Pittsburgh, Pa., has secured a federal permit to dredge and dump about 500 cubic yards of material in the vicinity of Duquesne, about 11 miles from the mouth of the river, to make a safer landing at the Duquesne hoist.

The Marlborough Sand and Gravel Co., Marlborough, N. Y., is operating its sand and gravel plant with about 15 men having cut to this number from about 50. Work at the plant was resumed on May 20, after being idle for about a month. The plant is not operating at full capacity and is only turning out about five barge loads of gravel a day.

Cement

Oklahoma City, Okla.—Five companies are supplying builders and contractors of Oklahoma with building sand from the unlimited deposits in the wide stretches of the Big Sandy River, near Ada. This river sand is a fine grade of building sand and the companies have shipping facilities over three railroads, the Frisco, Santa Fe, and the Katy.

The Alpha Portland Cement Co., Easton, Pa., and Chicago, Ill., which owns and operates a plant at Jamesville, N. Y., has won an important tax litigation in the United States Supreme Court. New York State attempted to assess a franchise tax on the income from $4,500,000 assets held by the company in a Pennsylvania corporation. The lower court upheld the objections of the company, and now the highest court refuses to review the decision. The decision clarifies the law and will relieve corporations possessing assets both in and outside the state of the threat of having additional tax burdens imposed.

Classified Advertising

Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. please send check with your order. These ads must be paid in advance of insertion.

Repaired Contractors' Equipment

Steam Shovels

Model 60 Marion Shovels, 2½-yard dippers, Nos. 1999, 2059, 2130

1—Model 1 Thew, on railroad trucks, ⅞-yard dipper.

1—Bucyrus Model 70-C, Shop No. 1219.

2—Model 28 Marion Revolving, ⅝-yard dippers.
1—Model O Thew Revolving, ½-yard dippers.
1—Type "B" Erie Revolving, ¾-yard dippers.

We have a large stock of thoroughly repaired Construction Equipment of all kinds ready for immediate shipment.

Locomotives

8—18-ton, 10x16" Porter Dinkeys, 36" gauge.
2—12-ton, 9x14" Porter Dinkeys, 36" gauge.
1—17x24", 55-ton, 4-6-0, standard gauge.
3—25-ton Forney type.

Clam Shell Buckets

1—1¼-yard Williams Hercules Bucket.

Cars

30—Western Air Dump 12-yard, standard gauge.
40—Western 4-yard, 36" gauge, steel beam.

H. KLEINHANS COMPANY
Union Arcade **Pittsburgh, Pa.**

New Steam Shovel at Second Hand Price

Atlantic type, 2½ yard. Bought of Bucyrus Company.

Vermont Milling Products Corp.
Fair Haven, Vermont

Immediate Delivery
6, 7½, 9, 10 and 18 K Crushers

18 K ANGLE DR. $11,000.00.
No. 4 GYRATORY CRUSHING PLANT. N. Y.
No. 36 DISC CRUSHER, MANG. FITTED.
2—150-Hp. 125-lb. Marine type boilers and others.
No. 10 McCULLY—BARGAIN, $6,750.00.
4 No. 6 Gates (Mang. Fit.) nickel steel shafts.
50- and 75-Hp. single drum hoists for motor drive.
No. 2, 3 and 4 Gates, reg. drive crushers.
Air Compressors (steam-belt) 50 to 4000 ft.
5, 6 and 12 ton, 24-in. gauge gasoline locomotives.
1—8x8 and 10x10 Air Comp. (belt).
2—180-ft. Quick Shift, 30-ft. bucket towers.
6-in., 8-in. and 10-in. SAND PUMPS.
25—40-Hp. Thomas D. D. Elec. Hoist, 440 V. A. C.
5,- 10- and 15-ton HOLT TRACTORS, PRAC. NEW.
1, 2 and 3 DRUM STEAM AND ELEC. HOISTS.
Send us your inquiries—Sand Pumps, Motors, Contractors' Equipment, etc.

ROSS POWER EQUIP. COMPANY
Indianapolis, Ind.

For Sale

One 12x20 Buchanan Jaw Crusher; one Baldwin Locomotive, 16-ton, narrow-gauge; one Vulcan Locomotive, 16-ton, narrow-gauge.

All in good condition.

Hodgson Sand & Gravel Co.
Stanhope, N. J.

FOR SALE

9x16" Climax Jaw Crusher.
No. 2 Style D Gates Gyratory Crusher.
75 H. P. 13x16" Erie Steam Engine.
125 H. P. 18x24" Atlas Steam Engine.
12x12" Lidgerwood Standard, Double Cylinder 2 Drum Cableway Engine.
600 lineal feet 1¾" Roebling Wire Cable.
100 H. P. Motor and 100 K. W. Generator.
Both 550 volts and 60 cycles.

E. W. Cooper, 174 3rd Ave. No., Nashville, Tenn.

FOR SALE

One Erie Steam Shovel, Type B, No. 1321, in perfect condition; only been used 4 months.

The Smallwood-Low Stone Co.
Lisbon, Ohio

Two Sauerman Draglines

Have just released two outfits, a 1¼ cu. yd. and a 1⅓ cu. yd., complete, with hoists, boilers, pumps, pipeing, cables, settling tanks, etc. Full details and prices furnished on request.

THE UNDERWOOD-WALKER CO.
1822 Jefferson Bank Bldg. Birmingham, Ala.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

One 50-ton, standard gauge Baldwin Mogul; 170 lbs. pressure.

One 56-ton, standard gauge American 10-wheeler; 175 lbs. pressure.

Two 50-ton, standard gauge Brooks 6-wheel switchers; 160 lbs. pressure.

One 42-ton, standard gauge Shay geared locomotive.

One 24-ton, standard gauge Shay geared locomotive.

One 14-ton, 36" gauge American Saddle Tank.

Two 23-ton, brand new 36" gauge Porter 6-wheel switchers; separate tenders.

One Model 14-B Bucyrus Shovel.

The above are only a few items of our stock. Will gladly send you our complete stock lists.

Birmingham Rail & Locomotive Co.
Birmingham, Ala.

Locomotives for Rent and Sale

2—32-ton Vulcan four-driver saddle-tank, used sixty days, built March, 1921.
1—40-ton 17x24" four-wheel switcher.
2—50-ton 18x24" six-wheel switchers.
2—NEW 25-ton six-wheel Porters, separate tenders, 36" gauge.
2—18, 14, and 10-ton Vulcans, 36" gauge.

MISCELLANEOUS

13—6-yd. rebuilt dump cars, std. gauge.
20—12-yd. Westerns, like new, std. gauge.
50—60,000-lb. capacity flat and box cars.
1—Western standard gauge spreader.
1—Osgood 18 revolving shovel, traction wheels, No. 794.
1—Marion 36 steam shovel on traction wheels.
1—Marion 76 steam shovel, No. 3503, std. gauge.

2-in., 4-in., and 6-in. simple, duplex, and centrifugal pumps, new 3-drum hoists, road rollers, and tripod drills.

Locomotive-Cranes, Railway Equipment, etc.

INDUSTRIAL EQUIPMENT CO.
McCormick Building, Chicago, Ill.

FOR SALE

2 Heine Watertube Boilers, 409 Hp. each. For further particulars address

Phoenix Portland Cement Co.
Nazareth, Pennsylvania

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½ x25', 4x30', 5½x50' 6x50' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 3½x25', 5x60' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 2½x3" 3x3½' pebble and ball mills; 8x4', 6x4' and 4x4' continuous ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; **4½x20', 5x11', 5x20', 5½x22' and** 6x20' tube mills; 7½x13", 9x15", 16x10" and 30x60" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; **one Kent type "G" mill; 36" and** 40" cage mills; 3' and 4½' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one **No. 2 Sturtevant ring roll crusher; 3 roll and** No. 000, No. 00 and No. 0 Raymond mills; one No. 5 Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; one keystone excavator; 6x8', 6x5' and 4x3' Newaygo vibrating screens, Richardson **automatic scales.**

Air compressors and tanks.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

New Rubber Belting

300 ft. 12" 6-ply	$0.99	per foot
423 ft. 14" 5-ply	1.04	per foot
527 ft. 14" 6-ply	1.25	per foot
529 ft. 16" 6-ply	1.39	per foot
520 ft. 16" 8-ply	1.90	per foot
150 ft. 18" 6-ply	1.48	per foot
512 ft. 18" 8-ply	2.00	per foot
216 ft. 24" 8-ply	3.15	per foot

Rolls Cut to Any Length

National Belting and Salvage Company
268 East Water Street Milwaukee, Wis.

SEVERAL BELT BARGAINS

98 ft. 24" 4-ply Rubber-Covered Conveyor Belting, slightly used..............$1.50 per foot
100 ft. 30" 8-ply Canvas-Stitched Belting, slightly used..............$1.62 per foot

NATIONAL BELTING AND SALVAGE CO.
268 East Water St., Milwaukee, Wisconsin

NO. 8-D, GATES GYRATORY CRUSHER

STANDARD DRIVE

Fitted with manganese head and concaves. Included with this crusher, we have the following extra spare parts:

1 New, Manganese head.
1 New, set of manganese concaves.
1 New, main shaft.
1 New, Spider, and 2 New, eccentrics.

We also have many other sizes and types. We specialize in good quarry equipment of all classes. Write us fully.

Reading Engineering Co., Inc.
1227 Tribune Bldg., New York, N. Y.

"Everything for the Quarry"

⅝-yd. Thew "O" Traction Shovel.
3-ton Plymouth 4' 8½" ga. Gasoline Locomotive.
7x12 cyl. 36-in. gauge Davenport Saddle Tank.
9x14 cyl. 36-in. gauge Vulcan Saddle Tank.
10x16 cyl. 36-in. gauge Porter Saddle Tank.
10—24-in. gauge 1½-yd. Western Dump Cars.
15—36-in. gauge 4-yd. Western Dump Cars.
3—16-yd. Western Air Dump Cars.
33-in. R. H. Lehigh Fuller Mills.
7x10 and 8x10 DC, DD Hoisting Engines.
Rails, Boilers, Derricks, Steam Shovels, Tanks.

ZELNICKER IN ST. LOUIS
Before You Buy Get Big Bulletin 290.

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

When in the market for machinery or equipment, look through the advertisements of ROCK PRODUCTS. If you do not find what you want advertised in this issue, write us and we will put you in touch with reliable firms who can supply your need. This service is free to our readers. Use it.

Rock Products

The Nation's Business Magazine of the Rock Products Industry

542 South Dearborn Street Chicago, Illinois

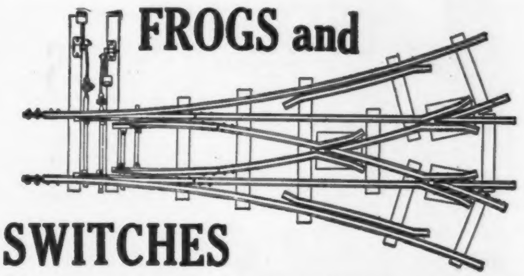
The Advance Engineering Company
Cleveland, Ohio

The "ADEN" Crane and Bucket

Special Interest to Sewer Contractors and Special Excavation Problems

E. 140 St. Sewer, Cleveland, O.,—34-Yd. Heavy Bucket beingused

FROGS and SWITCHES



The Central Frog & Switch Co., Cincinnati, O.

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fishplates, Throws, Rail Braces, Tie Plates, Portable Track, Etc., Etc.

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS
dig, convey, elevate and dump in one operation

Cost data furnished by prominent gravel producers who are using Sauerman equipment backs up our claim that sand and gravel can be excavated and conveyed from pit to plant by one of our drag-line cableway excavators at a lower cost per ton than by using any other equipment or combination of equipment.

Write for Catalog No. 7

Sauerman Bros.
1140 Monadnock Bldg.
Chicago
Also Mfrs. of Power Scrapers

BYERS Cranes

This is our new Full-Revolving type, built on highest locomotive-crane standards. Byers "Auto-Crane"—half circle swing—completes the line; provides equipment meeting the crane needs of every contractor. Interesting booklet gladly sent.

THE BYERS MACHINE CO.
310 Sycamore St.
RAVENNA, OHIO

Sales Offices Everywhere

ANCHOR BRAND COLORS

For Mortar, Cement and Brick—Brown, Black, Red and Buff—Strongest and Most Durable

Manufactured by

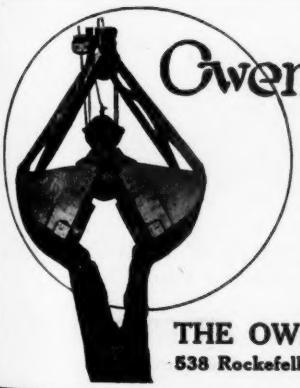
C. K. Williams & Co.

Correspondence Solicited **EASTON, PA., U. S. A.**

PERFORATED SCREENS

We have the technical knowledge and the equipment that enables us to meet your most exacting needs quickly.

NORTMANN-DUFFKE CO.
1200 27th Ave.
MILWAUKEE, WIS.



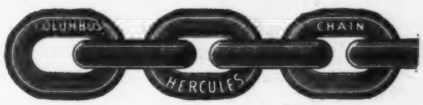
Owen Buckets

combine dollar-saving features of bucket construction which are illustrated in our latest catalogue.

Write for it today.

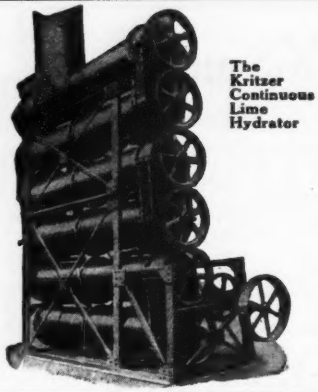
THE OWEN BUCKET CO.
538 Rockefeller Bldg., Cleveland, Ohio

"Hercules Solid Weld" Steam Shovel Chains



Best In the World. Will Actually Wear Out

The Columbus McKinnon Chain Company
Columbus, Ohio



The Kritzer Continuous Lime Hydrator

HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY
503 South Jefferson Street CHICAGO, ILL.

PORTER LOCOMOTIVES

For Every Purpose

H. K. PORTER COMPANY
PITTSBURGH, PA.

Maddox Foundry & Machine Company
ARCHER, FLORIDA

Manufacturers of the

Abbott Improved Crusher Feeder

Indispensable where clay or sticky material is mined.

We manufacture washing, crushing and drying machinery for phosphate and lime rock, suction and dipper dredges.

We contract for complete plants.

EASTON CARS

Ruggedly constructed Easton Scoop Cars, cars of all types, standard or special, and complete narrow gauge railway equipment from track up—built for enduring service and backed up by thirty years of Easton experience—are available for every car haulage requirement in the rock products industry.

EASTON CAR & CONS'T'N CO

49 Dey Street, New York Works: Easton, Pa.

Atlanta, Boston, Chicago, Cleveland, Dallas, Detroit, Los Angeles, Philadelphia, Pittsburgh, Salt Lake City

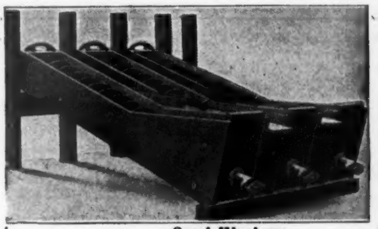
---

OHIO LOCOMOTIVE CRANES
OHIO LOCOMOTIVE CRANE CO.
POPLAR ST. BUCYRUS, OHIO

for elevators, dredges, lumbering, mining, oil-well drilling, suspension bridges, stump pulling, cranes, derricks, ships' rigging and every other form of wire rope use

Illustrated Catalogue —Free

American Steel & Wire Co.
Chicago New York



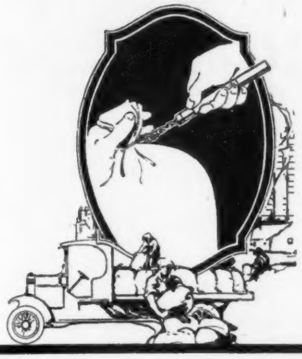
Sand Washers

9-Foot Dry Pan

Lewistown Foundry & Machine Co.
LEWISTOWN, PA.

Builders of heavy duty crushers and glass sand machinery. Glass sand plants equipped complete.

Write for prices and catalog



BATES TIED BAGS

Save Your Money—FREE TRIAL

Your bag tying costs are entirely too high—unless you now use the Bates Wire Bag Tying System. For economy, speed, security and durability you owe it to yourself to investigate the Bates System for your Bag Tying Work. It will pay you to try and then buy.

Write for your FREE Trial Bag Tying Outfit—Today

The Bates Free Trial Bag Tying outfit, containing one Bates Spring Return Tying Tool and 10 each of 4, 4½, 5, 5½ and 6 inch Bates Wire Ties, will be sent you, on receipt of your signed agreement to try this Bag Tying Outfit on your work, and then, within 15 days, send $4.00 for the outfit or return the tool to us. These ties cost you nothing.

BATES VALVE BAG COMPANY

7326 South Chicago Ave.
Chicago, Ill.

110 Great Portland St.
London, W. I., England

AUSTIN

GYRATORY CRUSHERS

Stationary and Portable Types—Efficient—Economical—Reliable

The Gyratory type of Crusher has numerous features of proven worth.

The Austin has six features not found in any other Gyratory Crusher.

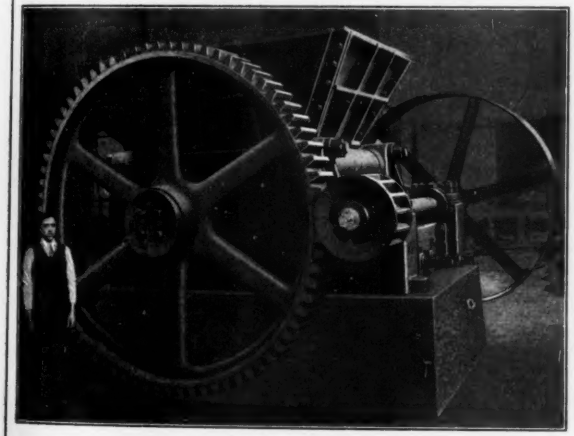
Catalog twenty-eight should be in the hands of every one interested in Crushers. Write for your copy today.

AUSTIN MANUFACTURING CO.

New York Chicago San Francisco

Canadian Agents:
Mussens Limited, Montreal, Toronto, Vancouver
Canadian Fairbanks-Morse Company Limited, Winnipeg, Calgary, Saskatoon

EXPORT DEPARTMENT
ALLIED MACHINERY COMPANY OF AMERICA



If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

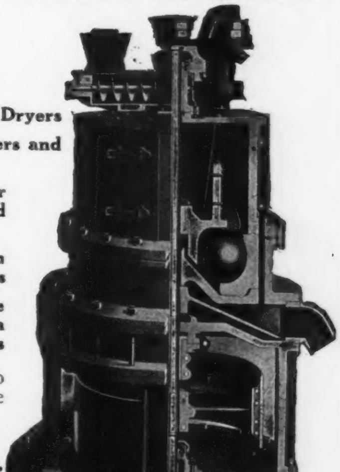
Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.

Hollidaysburg, Pa.

Screens, Elevators, Conveyors, Rock Washers, Etc.

FULLER PRODUCTS *for* FULLEST SATISFACTION



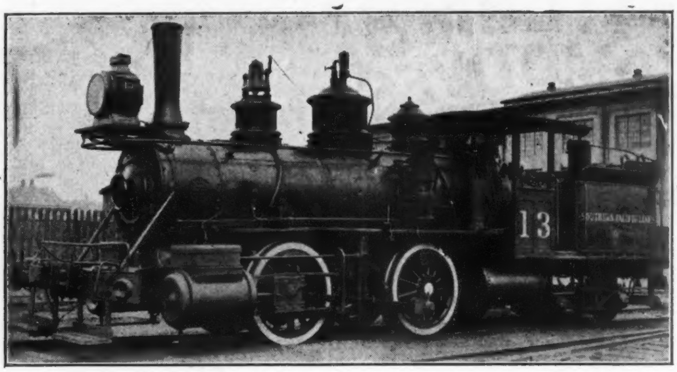
- Preliminary Mills
- Pulverizing Mills
- Crushing Rolls
- Direct and Indirect Fired Dryers
- Ball and Tube Mill Liners and Partition Plates
- Fuller Kinyon System for Conveying Pulverized Materials
- Sprockets, Traction Wheels and Roll Heads
- All Kinds of High Grade Chilled Charcoal Iron Castings for All Uses

We will be pleased to send catalogue and quote on your requirements.

Fuller-Lehigh Co.

MAIN OFFICE AND WORKS:
Fullerton, Pa., U. S. A.

BRANCHES:
New York Chicago Seattle Montreal



This

Baldwin Locomotive in excellent condition after forty-two years of continuous service

Every Baldwin locomotive is built to give full and complete service to its owners.

It is therefore no surprise to us to be in receipt of letters and photographs of Baldwin engines built many years ago and which are still in operation.

The illustration shows a Forney type, built by us in 1879 for Morgan's Louisiana and Texas Railroad, which is today in excellent condition and giving good service at Algiers, Louisiana, after forty-two years of continuous operation.

It has 17 x 24 inch cylinders and 49 inch driving wheels. The weight on drivers is 56,000 pounds and the total weight of engine is 70,000 pounds. Originally this locomotive was built to push freight cars up a very steep incline on the banks of the Mississippi and then hauling the same cars over the road. Today it is being employed for miscellaneous work.

Baldwin locomotives forty years ago and today represent the STANDARD OF EXCELLENCE

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

The Clyde Lime Hydrator Performance Counts

The Clyde was first in the field, and through dependable and economical performance is still first choice of lime operators.

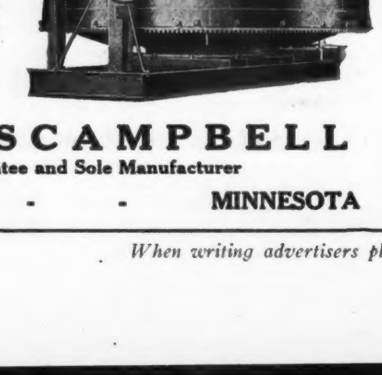
The Clyde Hydrator produces big capacities of lime at only three-fifths the cost of any other hydrator on the market.

The Clyde not only produces over 90% of the hydrate of America, but makes the best quality of finishing lime from either high calcium or magnesium.

Simple, easiest to operate and most economical in cost of installing, maintaining, and operating.

Send for Catalog

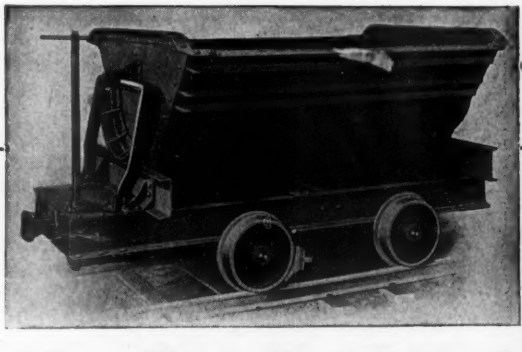
FIRST IN THE FIELD



H. MISCAMPBELL

Patentee and Sole Manufacturer

DULUTH - - MINNESOTA



More Than Reinforced

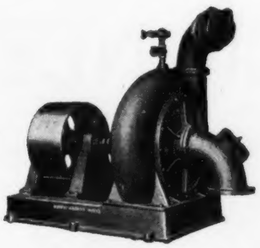
Reinforcing a dump car makes it stronger, of course. But there is a best way to reinforce. Atlas cars are reinforced the best way. Why? Simply because we have built dump cars so long and for so many people that we know just where the reinforcing should go and just how it should be done.

Not much wonder, then, that Atlas dump cars stand the "gaff" better than the average.

The Atlas Car & Manufacturing Co.

ENGINEERS MANUFACTURERS

CLEVELAND, OHIO, U. S. A.



Standard Belt Sand Pump

This type of pump is the result of 57 years' experience building dredging pumps. It is a heavy, durable pump for average service.

Built in sizes 4" and up.

Morris Machine Works
Baldwinsville, N. Y.

39 Cortlandt Street, New York City
Real Estate Trust Bldg., Philadelphia, Pa.
217 N. Jefferson St., Chicago, Ill.

Bulletin No. 19-B fully describes our complete line of sand and dredging pumps. Have you your copy?

Morris

Since the Civil War Builders of Centrifugal Pumps, Hydraulic Dredges, and Steam Engines

OSGOOD 18

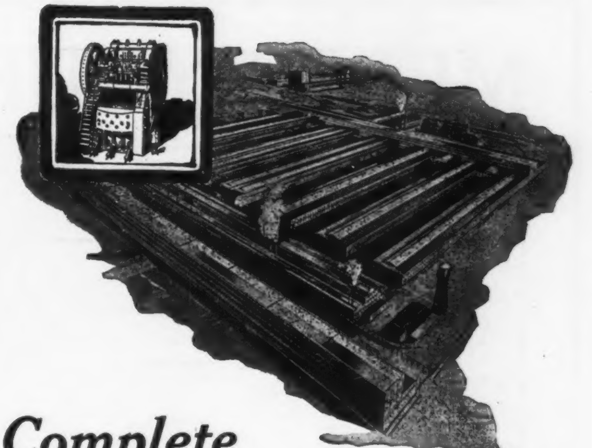
New Improved

1921 Model
STEAM SHOVEL

DON'T DELAY
Find Out About It

Write, Phone or Wire Today

The OSGOOD Company, Marion, Ohio



Complete Equipment Plus Engineering Service

PLANTS equipped under the Allis-Chalmers plan of "Undivided Responsibility" include the complete apparatus necessary for their successful operation.

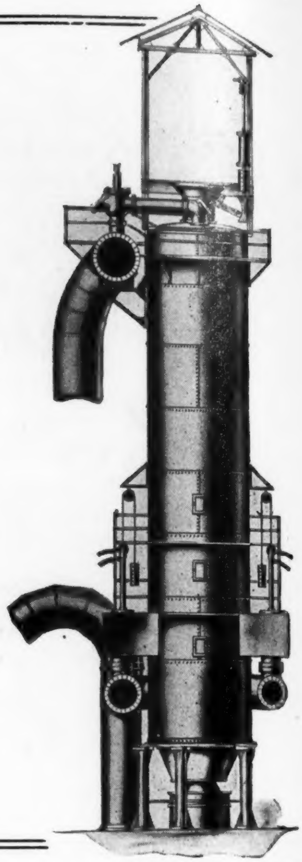
With the apparatus designed by its own engineering staff and built in its own shops, the Allis-Chalmers organization is able to include the complete equipment in a single contract, thus saving a purchaser the burden of handling the many details, disputes, delays and oftentimes expensive complications arising where a number of separate contracts are involved.

Allis-Chalmers engineering service is of the utmost value to a user in the selection of equipment suited to his particular conditions and in its economical operation for maximum plant efficiency.

Of particular interest to Rock Products readers is the following Allis-Chalmers Equipment.

- Crushing Machinery
- Complete Crushing Plants
- Cement Machinery
- Complete Cement Plants
- Dust Collecting Systems
- Powdered Coal Plants
- Air Compressor Equipment
- Centrifugal Pumps and Pumping Units
- Electric Motor Drive and Control Equipment
- Power Units with any Type of Prime Mover
- Complete Electrical Equipment "from Prime Mover to Switchboard"
- Power Transmission Machinery

ALLIS-CHALMERS
Manufacturing Company
Milwaukee, Wis., U. S. A.
District Offices in All Leading Cities.



Buyers' Guide of the Rock Products Industry

Classified Directory of Advertisers in Rock Products

Aerial Tramways

Interstate Equip. Co.
New York, N. Y.

Bags and Bag Machinery

Bates Valve Bag Co.
Chicago, Ill.

Jaite Co., The
Jaite, Ohio

Miller, Tompkins & Co
New York City.

Valve Bag Co. of America
Toledo, Ohio.

Belting

Cincinnati Rubber Mfg. Co.
Cincinnati, Ohio.

Hettrick Mfg. Co.
Toledo, Ohio

New York Belting & Packing Co
New York, N. Y.

Brick Machines

Wert Mfg. Co.
Chicago, Ill.

Blasting Supplies

Du Pont de Nemours & Co., E. I
Wilmington, Del.

Grasselli Powder Co.
Cleveland, Ohio.

Hercules Powder Co.
Wilmington, Del.

Buckets, Elevator

Hendrick Mfg. Co.
Carbondale, Pa.

Orton & Steinbrenner
Chicago, Ill.

Buckets

Advance Eng. Co.
Cleveland, O.

Blaw-Knox Co.
Pittsburgh, Pa.

Brown Hoisting Mach. Co.
Cleveland, Ohio.

Browning Co.
Cleveland Ohio.

Marion Steam Shovel Co.
Marion, Ohio.

McMyler Interstate Co.
Cleveland, Ohio.

Owen Bucket Co.
Cleveland, Ohio.

Cableways

S. Flory Mfg. Co.
Bangor, Pa.

Interstate Equip. Co.
New York, N. Y.

Calcining Machinery

Atlas Car & Mfg. Co.
Cleveland, Ohio.

Butterworth & Lowe
Grand Rapids, Mich.

Cement Machinery

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

Chains and Transmitting Machinery

Columbus-McKinnon Chain Co.
Columbus, O.

Conveyors and Elevators

Caldwell H. W., & Son Co.
Chicago, Ill.

Gifford-Wood Co.
Hudson, N. Y.

Jeffrey Mfg. Co., The
Columbus, Ohio.

Link Belt Co.
Chicago, Ill.

Robins Conveying Belt Co.
New York, N. Y.

Smith Eng. Works
Milwaukee, Wis.

Stephens-Adamson Mfg. Co.
Aurora, Ill.

Sturtevant Mill Co.
Boston, Mass.

Universal Road Mach. Co.
Kingston, N. Y.

Cranes—Locomotive Gantry

Advance Eng. Co.
Cleveland, O.

Ball Engine Co.
Erie, Pa.

Brown Hoisting Mach. Co
Cleveland, Ohio.

Browning Co.
Cleveland, Ohio.

Byers Mach. Co., The.
Ravenna, Ohio.

Chisholm-Moore Mfg. Co
Cleveland, Ohio.

McMyler-Interstate Co.
Cleveland, Ohio.

Ohio Locomotive Crane Co.
Bucyrus, Ohio.

Orton & Steinbrenner
Chicago, Ill.

Osgood Co., The
Marion, Ohio.

Crushers and Pulverizers

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

American Pulverizer Co.
St. Louis, Mo.

Austin Mfg. Co.
Chicago, Ill.

Bacon, Earle C., Inc.
New York, N. Y.

Buchanan Co., Inc., C. G.
New York, N. Y.

Butterworth & Lowe
Grand Rapids, Mich.

Chalmers & Williams
Chicago Heights, Ill.

Fuller-Lehigh Co.
Fullerton, Pa.

Gruendler Pat. Crusher & Pulv. Co.
St. Louis, Mo.

Jeffrey Mfg. Co., The
Columbus, Ohio.

K. B. Pulverizer Co.
New York, N. Y.

Kennedy-Van Saun Mfg. & Eng. Corp
New York, N. Y.

Kent Mill Co.
Brooklyn, N. Y.

Lewistown Fdry. & Mach. Co.
Lewistown, Pa.

McLanahan-Stone Mach. Co.
Hollidaysburg, Pa.

Munson Mill Machinery Co.
Utica, N. Y.

New Holland Machine Co.
New Holland, Pa.

Pennsylvania Crusher Co.
Philadelphia, Pa.

Raymond Bros. Impact Pulverizer Co.
Chicago, Ill.

Smidth & Co., F. L.
New York, N. Y.

Smith Eng. Works
Milwaukee, Wis.

Sturtevant Mill Co.
Boston, Mass.

Stevenson Co.
Wellsville, O.

Traylor Eng. & Mfg. Co.
Allentown, Pa.

Universal Crusher Co.
Cedar Rapids, Iowa.

Universal Road Mach. Co.
Kingston, N. Y.

Webb City & Carterville F. & M. Works
Webb City, Mo.

Williams Pat. Crush. & Pulv. Co
Chicago, Ill.

Crusher Feeder

Maddox Fdy. & Machine Co.
Archer, Fla.

Derricks

Terry Mfg. Co.
New York, N. Y.

Dipper Teeth

American Manganese Steel Co.,
Chicago Heights, Ill.

Dragline Buckets

Brown Hoisting Mach. Co
Cleveland, Ohio

Drills

Armstrong Mfg. Co.
Waterloo, Iowa.

Sanderson Cyclone Drill Co.
Orrville, Ohio

Wood Drill Works
Paterson, N. J.

Dryers

American Process Co.
New York City.

Vulcan Iron Works
Wilkes-Barre, Pa.

Dynamite

Du Pont de Nemours & Co., E. I.
Wilmington, Del.

Grasselli Powder Co.
Cleveland, Ohio.

Hercules Powder Co.
Wilmington, Del.

Engines, Oil & Gas

Novo Engine Co.
Lansing, Mich.

Engines, Steam

Morris Mach. Works
Baldwinsville, N. Y.

Novo Engine Co.
Lansing, Mich.

Engineers

Alden, Wilterding & Scott
Toledo, Ohio

Arnold & Weigel
Woodville, Ohio

Bacon, Earle C., Inc.
New York, N. Y.

Buckbee Co., J. C.
Chicago, Ill.

Fuller Engineering Co.
Allentown, Pa.

James N. Hatch
Chicago, Ill.

R. W. Hunt & Co.
Chicago, Ill.

Massey Co., Geo. B.
Chicago, Ill.

Smidth & Co., F. L.
New York, N. Y.

Schaffer Eng. & Equip. Co
Pittsburgh, Pa.

Excavators

Ball Engine Co.
Erie, Pa.

Marion Steam Shovel Co.
Marion, Ind.

Owen Bucket Co.
Cleveland, Ohio.

Excavators—Dragline Cableway

Link Belt Co.
Chicago, Ill.

Sauerman Bros.
Chicago, Ill.

Explosives
Du Pont de Nemours & Co., E. I.
Wilmington, Del.
Grasselli Powder Co.
Cleveland, Ohio.
Hercules Powder Co.
Wilmington, Del.

Fuses
Ensign-Bickford Co.
Simsbury, Conn.

Gas Producers
Morgan Construction Co.
Worcester, Mass.

Gears
Caldwell, H. W. & Son Co.
Chicago, Ill.
Tool Steel Gear & Pinion Co.
Cincinnati, Ohio.

Generators
Sorgel Electric Co.
Milwaukee, Wis.

Glass Sand Equipment
Lewistown Fdy. & Mach. Co.
Lewistown, Pa.

Grates
The Kramer Bros. Fdy. Co.
Dayton, Ohio.

Grinding Mills
Munson Mill Machinery Co.
Utica, N. Y.

Hoists
Chisholm-Moore Mfg Co.
Cleveland, Ohio
Flory Mfg. Co., S.
Bangor, Pa.
Novo Engine Co.
Lansing, Mich.
Vulcan Iron Works
Wilkes-Barre, Pa.

Hose—Water, Steam, Air Drill, Pneumatic Tool
Cincinnati Rubber Mfg. Co.
Cincinnati, O.
N. Y. Belting & Packing Co.
New York, N. Y.

Hydrating Machinery
Atlas Car & Mfg. Co.
Cleveland, Ohio
Kritzer Co., The
Chicago, Ill.
Miscampbell, H.
Duluth, Minn.
Schaffer Eng. & Equip. Co.
Pittsburgh, Pa.
Toepfer & Sons Co., W.
Milwaukee, Wis.

Hydraulic Dredges
Morris Machine Works
Baldwinsville, N. Y.

Industrial Cars
Atlas Car & Mfg. Co.
Cleveland, Ohio
Easton Car & Constr. Co.
Easton, Pa.
Watt Mining Car Wheel Co.
Barnesville, Ohio

Lime Kilns
Arnold & Weigel
Woodville, Ohio
Glamorgan Pipe & Fdy. Co.
Lynchburg, Va.
Steacy-Schmidt Mfg. Co.
York, Pa.
Vulcan Iron Works
Wilkes-Barre, Pa.

Loaders and Unloaders
Barber-Greene Co.
Aurora, Ill.
Ball Engine Co.
Erie, Pa.
Jeffrey Mfg. Co., The
Columbus, Ohio

Locomotives
Baldwin Locomotive Works The
Philadelphia, Pa.
Cummings Mach. Co.
Minster, Ohio.
Fate-Root-Heath Co.
Plymouth, Ohio
Hadfield-Penfield Steel Co.
Bucyrus, Ohio
Jeffrey Mfg. Co., The
Columbus, Ohio
Lima Locomotive Works
New York, N. Y.
Porter Co., H. K.
Pittsburgh, Pa.
Vulcan Iron Works
Wilkes-Barre, Pa.
Whitcomb Co., Geo. D.
Rochelle, Ill.

Motors, Electric
Sorgel Electric Co.
Milwaukee, Wis.

Motor Trucks
Pierce-Arrow Motor Car Co.
Buffalo, N. Y.
Traylor Eng. & Mfg. Co.
Allentown, Pa.

Packing—Sheet, Piston, Superheat, Hydraulic
Cincinnati Rubber & Mfg. Co.
Cincinnati, Ohio
N. Y. Belting & Packing Co.
New York, N. Y.

Paint and Coatings
Williams, C. K., & Co.
Easton, Pa.

Perforated Metals
Chicago Perforating Co.
Chicago, Ill.
Cross Eng. Co.
Carbondale, Pa.
Harrington & King Perf. Co.
Chicago, Ill.
Hendrick Mfg. Co.
Carbondale, Pa.
Nortmann Duffke Co.
Milwaukee, Wis.

Pinions
Tool Steel Gear & Pinion Co.
Cincinnati, Ohio.

Pipe Joints
Berry Flexible Pipe Joint Co.
Philadelphia, Pa.

Plaster Machinery
Butterworth & Lowe
Grand Rapids, Mich.
Ehrsam & Sons Co., J. B.
Enterprise, Kan.

Portable Conveyors
Stephens-Adamson Mfg. Co.
Aurora, Ill.

Pumps
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.
American Manganese Steel Co.
Chicago Heights, Ill.
Kansas City Hay Press & Tractor Co.
Kansas City, Mo.
Morris Machine Works
Baldwinsville, N. Y.

Power Transmitting Machinery
Caldwell H. W., & Son Co.
Chicago, Ill.

Powder
Du Pont de Nemours & Co., E. I.
Wilmington, Del.
Grasselli Powder Co.
Cleveland, Ohio
Hercules Powder Co.
Wilmington, Del.

Pulverized Fuel Equipment
Fuller-Lehigh Co.
Fullerton, Pa.
Raymond Bros. Impact Pulv. Co.
Chicago, Ill.

Pump Valves
N. Y. Belting & Packing Co.
New York, N. Y.

Quarry Equipment
Marion Steam Shovel Co.
Marion, Ohio
Universal Road Mach. Co.
Kingston, N. Y.

Rope, Wire
American Steel & Wire Co.
Chicago, Ill.
Leschen, A. & Sons Co.
St. Louis, Mo.

Scrapers, Drag
Sauerman Bros.
Chicago, Ill.

Screens
Cross Eng. Co.
Carbondale, Pa.
Diamond Mfg. Co.
Wyoming, Pa.
Hendrick Mfg. Co.
Carbondale, Pa.
Jeffrey Mfg. Co., The
Columbus, Ohio
Link Belt Co.
Chicago, Ill.
National Engineering Co.
Chicago, Ill.
Smith Eng. Works
Milwaukee, Wis.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
Stimpson Equip. Co.
Salt Lake City, Utah
Sturtevant Mill Co.
Boston, Mass.
Tyler Co., The W. S.
Cleveland, Ohio
Universal Road Mach Co.
Kingston, N. Y.

Separators
Rubert M. Gay Co.
New York City.
Raymond Bros. Impact Pulv. Co.
Chicago, Ill.
Sturtevant Mill Co.
Boston, Mass.
Tyler Co., The W. S.
Cleveland, Ohio

Separators, Magnetic
Buchanan Co., C. G., Inc.
New York, N. Y.

Shovels—Steam and Electric
Ball Engine Co.
Erie, Pa.
Bucyrus Co.
S. Milwaukee, Wis.
Marion Steam Shovel Co.
Marion, Ohio
Osgood Co., The
Marion, Ohio

Shoveling Machines
Myers-Whaley Co.
Knoxville, Tenn.

Stucco Facings
The Metro-Nite Co.
333 Hartford Ave. Milwaukee, Wis.

Testing Sieves and Testing Sieve Shakers
Tyler Co., The W. S.
Cleveland, Ohio

Track Equipment
Central Frog & Switch Co.
Cincinnati, Ohio
Easton Car & Constr. Co.
Easton, Pa.

Tramways
Interstate Equip. Co.
New York, N. Y.

Trolleys
Brown Hoisting Mach. Co.
Cleveland, Ohio

Turntables
Easton Car & Const. Co.
Easton, Pa.

Washers, Sand and Gravel
Link Belt Co.
Chicago, Ill.
Smith Eng. Works
Milwaukee, Wis.

Wire Rope
American Steel & Wire Co.
Chicago, Ill.
Leschen, A., & Sons Co.
St. Louis, Mo.

Wire Cloth
Cleveland Wire Cloth Co.
Cleveland, Ohio
Tyler Co., The W. S.
Cleveland, Ohio

INDEX TO ADVERTISEMENTS

End

921